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JOURNEYS IN THE SIAMESE EAST COAST STATES.*

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This Society may be said to have almost circumnavigated the Malay peninsula, and to-night's paper is the completion of the journey. At various dates the Tenasserim provinces, the Siamese west coast provinces,† and the Malay states,‡ which are now federated under Great Britain, have been described. On the east coast Mr. Clifford has given a graphic account of Pahang, Tringkanu, and Kelantan;§ and Prof. Henry Louis has ably treated of the group of small states immediately to the north, which, before the Siamese occupation, formed the once famous state of Patani.‖

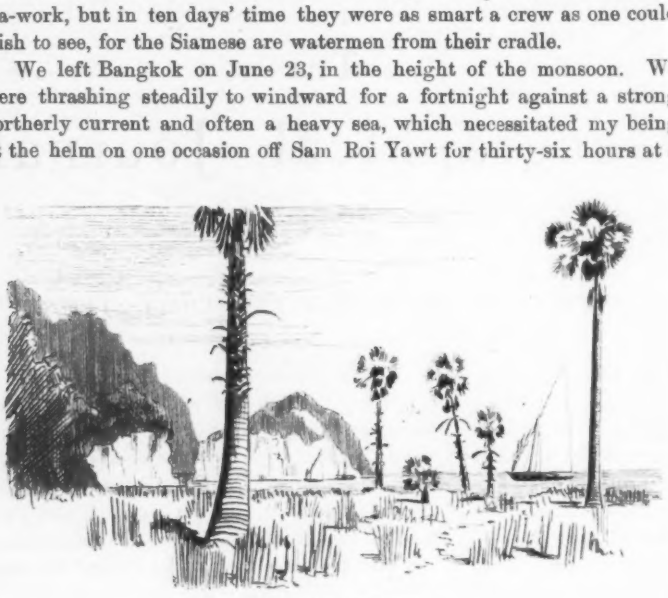
In the summer of 1896 I had occasion to visit officially for the Siamese Government the chief tin-producing states on the east coast north of Singora.

Nearly the whole of the trade of these 600 miles of coast is carried on by junks; during the finer months, however, two small native-run steamboats visit some of the more important places. It was impossible to make their sailings fit in with the work before us, and, as the Government had not any vessel to place at our disposal, I hired a sailing-boat about 36 feet long, and fitted her out for the voyage. She had been originally built as a steam-launch, and consequently want of beam was her worst feature. At first she leaked like a basket, but by careful caulking we reduced the incoming of water to about eight buckets per diem in smooth sea. Of course we made much more in bad weather—that was generally. She was rigged with the China lug-sails of the

* Paper read at the Royal Geographical Society, January 17, 1898. Map, p. 580.
† *Geographical Journal*, vol. vi. Nos. 5, 6. ‡ *Proceedings R.G.S.*, vol. iv. No. 7.
§ *Geographical Journal*, vol. ix. No. 1. ‖ *Ibid.*, vol. iv. No. 3.

pattern usual in those seas—and very handy they are with a native crew, especially for quick reefing in the heavy squalls of the south-west monsoon, which we continually experienced. My companions were Nai Suk, the cheerful comrade of so many other journeys, and my two servants and two boatmen—all Siamese. They were amateurs at sea-work, but in ten days' time they were as smart a crew as one could wish to see, for the Siamese are watermen from their cradle.

We left Bangkok on June 23, in the height of the monsoon. We were thrashing steadily to windward for a fortnight against a strong northerly current and often a heavy sea, which necessitated my being at the helm on one occasion off Sam Roi Yawt for thirty-six hours at a



UNDER SAM ROI YAWT.

stretch. The ship was as wet below as on deck. The native craft did not like it, and were all in the little harbour along the coast, and it was only later on, when the weather fined up a bit, that we had company with us. If the weather is not fair, the native mind cannot see why any man should be so childish as to defy the decrees of fate by banging about outside, when he might be lying snugly at anchor, smoking.

The coast as far as Champawn is characterized by a number of wide bays stretching their spotless sand-beaches in scarcely perceptible curves to the horizon. Behind lies the sombre ever-piping jungle, relieved here and there by some jaggary or cocoanut palms, and an occasional cottage roof. Detached masses of limestone occur at intervals on steep-sided islands or high-peaked promontories, their serrated ridges, sometimes 2000 feet in height, forming conspicuous landmarks to the seafaring people using the gulf, and affording here and there good harbours for small craft. In the intense clearness of the early morning atmospheres, we used to see Sam Roi Yawt like a distant island 45

miles off. This headland is the noblest of all, and dominates the gulf like a huge cathedral—and aptly is it named the three hundred peaks.

The relations of these various rock-masses to one another have been long ago lucidly set forth by Siamese geologists, and, what in geological matters is more remarkable, all the authorities are unanimously agreed upon the subject. It appears that one Mong Lai and his wife once inhabited the neighbourhood (they were giants), and each promised their daughter in marriage, unknown to the other, to a different suitor. At last the day of the nuptials arrived, and Chao Lai and the Lord of Muang Chin * both arrived to claim the bride. When the horrified father found how matters stood—having a regard for the value of a promise which is not too common in the East—he cut his daughter in half, that neither suitor should be disappointed. Chao Lai, in the mean time, on finding that he had a rival, committed suicide, and the peak of Chaolai is the remains of his body. The unfortunate bride is to be found in the islands off Sam Roi Yawt, the peaks of which are the remains of the gifts which were to be made to the holy man who was to solemnize the wedding; while Kaw Chang and Kaw Kong, on the east side of the gulf, are the elephant and buffalo cart in which the presents were brought.†

Inland the densely wooded granites of the main ridge, forming the divide between Siam and Tenasserim, tower up into the monsoon clouds. At no point are they very distant from the coast-line, and the streams which drain their eastern slopes are but short and rapid mountain torrents.

The shoulders of the hills in places jostle the north and south trail out on to the beach, and the land wind comes off them laden with jungle fever. Except behind the bolder headlands, there is scarcely any flat land available for padi culture. Between the rich plain of Petchaburi and that of Champawn, there is not more than one acre of cultivation to every square mile of forest. The villages are few and the population small. A group of houses generally nestles under each of the great headlands, and the people are mostly fishermen, who do a little gardening, and take an occasional cargo of jungle produce (rattans, horns, buffalo-skins, etc.) to Champawn, Petchaburi, or Bangkok. In the four provinces of Pran, Kuwi, Bangtapan, and Patiyu there are about 6000 people.

From Champawn southwards, a new phase of scenery is entered on. The great axial range retreats further westward, and the country is more productive and more populous. The low hills of the coast-line are comparatively bare of heavy timber, thanks to the heavy gales and the ever-advancing jungle fires. The people assume the distinctive

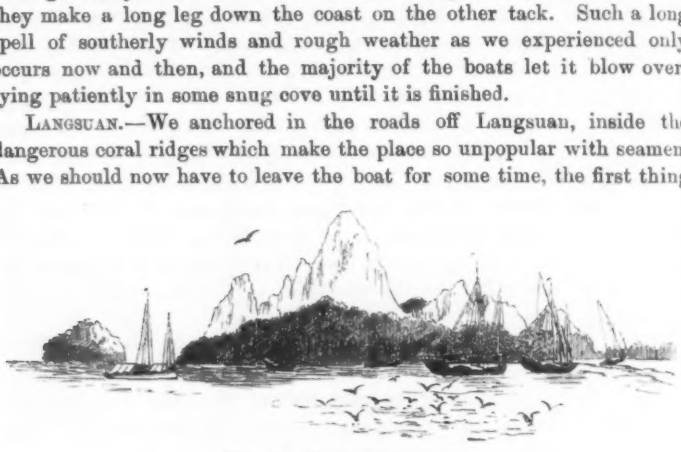
* China.

† All these stories bear striking evidence of the constant communication in early days between Indo-China and China.

peninsular type, Malay influences become observable, and the nasal twang and other peculiarities of dialect which had puzzled us so often on the west coast is very prominent.

As a rule, during the south-west monsoon the native sailing-boats rely on getting the wind somewhat off shore during the night—west or even north-west in direction. With this they make a long board seaward. Between 9 a.m. and noon they have a good offing, and as the wind generally shifts south or south-east during the day, for some hours they make a long leg down the coast on the other tack. Such a long spell of southerly winds and rough weather as we experienced only occurs now and then, and the majority of the boats let it blow over, lying patiently in some snug cove until it is finished.

LANGSUAN.—We anchored in the roads off Langsuan, inside the dangerous coral ridges which make the place so unpopular with seamen. As we should now have to leave the boat for some time, the first thing



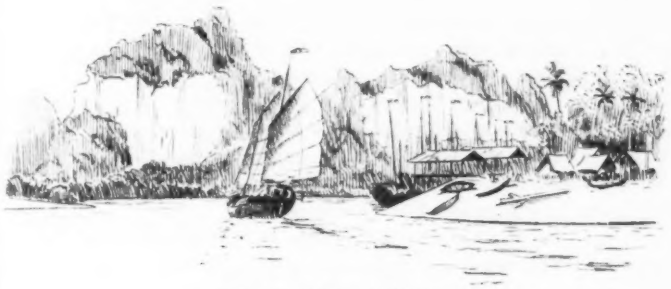
OUR ANCHORAGE AT KAW LAK.

was to get her into the river out of the exposed anchorage. Owing to the heavy rains, there was a 4-knot current coming out of the river across the bar, where there is only 6 feet at high water in the channel. We had to get in at night, when the wind was dead ahead, and the marks were completely hidden. Fortunately, a small junk went in at the same time, and we let her lead the way. As she had a Chinese crew, reinforced by some friends from the shore to assist in sweeping and quanting her in, she made an admirable pilot. Not only did every man shout continuously at the top of his voice, but great flares were continually made on the poop by the ignition of prayer-papers, burnt to propitiate the devil that was in that current. For once we thought there was some reason in Chinese superstitions. Several times the rush of water bore them away on to the shallow banks to the north of the channel, and the chorus ended in a melancholy howl, followed by a comic silence that made us all laugh. It necessitated two hours' ceaseless work at the quants and sweeps, and four or five successive attempts to get a distance of scarcely 400 yards to deep water inside.

Next day we equipped the skiff with a week's stores, and started up-river for the *muang*, or raja's residence, leaving two hands on board.

Langsuan literally means "the lower garden"—the garden of Lower Siam, as one may say—and the dense foliage along the river-banks, and the cold air laden with the scent of fruit which came off to us, showed how applicable is the name.

The *muang* lies about four hours' pull up-river from the sea. It was thus, like most of the *muangs* on the coast, well out of reach of the piratical junks which even twenty years ago were none too rare. If you know Henley reach, and indue it by the aid of your imagination with a rapid turbid current, and bold forest-clad hills along its banks, you will have a very fair idea of the scenery of the river. The town consists of a street of the wide-roofed, low-walled shanties affected by the Chinese in the peninsula, and some scattered houses of the usual Siamese type nestling under the dense durian orchards and palm plantations about the valley.



THE ENTRANCE TO LANGSUAN.

The governor's residence is a two-storied brick bungalow, not unlike a country house at home. In the compound lived the usual assortment of women-folk, slaves, police and criminals, pigs and pariahs, and a herd of half-wild ponies, who galloped out at daybreak to the jungle and galloped back at nightfall—to which we four were now added. We were given a couple of rooms in a house tenanted by a score of youngsters being trained to perform in the raja's private theatre. Their whole souls were wrapt up in the music, the repartee, and the attitudinizing necessary for the performances. They pounced upon us and our belongings like a swarm of flies, but their insatiable curiosity did not prevent their dinning theatrical "shop" into our ears by the hour together. Fortunately they rehearsed at night-time, and at some considerable distance, and from sunset to dawn one might catch the notes of a melancholy air floating through the mists, or the crash of a stirring Malay chorus.

The raja is a Chinaman, brother to the enlightened and successful rulers of Renawng and Trang upon the west coast, whose work has been already touched upon before this Society. He farms the state from the

Government for a given yearly sum. This is an old-fashioned Indo-Chinese method which has not always worked badly.

Langsuan is said to have a population of about sixteen thousand all told, of whom the greater part are Siamese, with a few Chinese and Malays. The state has been generally ignored altogether in maps. Its southern boundary lies a few miles south of the Muang, and the northern is formed by Klong Wisai, a stream emptying into Sawi bay, at the north-west corner; the northern end of the bay thus belongs to Champawn. On the south there is a considerable fishing population, largely Chinese, and in the bay itself their fish-traps, or *po*, may be seen scattered about its shallow waters. Southward there are few villages until Langsuan bay is reached, where again the *po* are conspicuous inside the reefs. At the time of our visit the fishery had been very unsuccessful, and the fish-bins, the salting-pits, and drying-stages were all empty, and a dozen *rue chalom*, the Chinese trading-boats, lay in the river waiting disconsolately for a cargo, while fresh arrivals came every day, unable to get freight at Pran Sawi or Champawn, and, for want of communication, ignorant of the state of affairs at Langsuan. Each *po* costs over £60,* and the upkeep of boat and crew is over £50† a year. In Champawn bay there were more than sixty, for it is a favourite place for the *pla tu*, the little herring-like fish for which they were all waiting; and in Langsuan there were another score of these traps, but not a fish in any of them. So no wonder the people were looking gloomy.

It is a curious, and, so far as I know, unexplained, fact that the *pla tu* is never caught south of Langsuan, although Bandon bight and other shallow water expanses in that direction seem to be exactly suited to them, during the prevalence of the south-west monsoon. A great number of large skate and shark are caught in seines along the beach.

The tin-mines of the state are chiefly situated along the edge of the granites of the main range which form the boundary between Langsuan and its eastern neighbour Renawng. The tin is all transported by elephant from the various mines to the river, and is then brought down in dug-out canoes. The mines are worked on the two systems known as *mueng kra* and *mueng sa*, which have been already described before the Society; but the latter, which are the ordinary open cast alluvial stream works, have been mostly worked out, and the greater part of the tin now comes from the *mueng kra*, or hill workings. The mining is, however, carried on in the same promiscuous manner as used to be the case with the old Cornish streamers. The Langsuan people, like the old men of Cornwall, are fishermen, husbandmen, and miners by turn, as the fancy takes them, or the season of the year suggests. When overtaken by a fit of industry, which is rare, or constrained by their own improvidence, which is more frequent, they go to the raja

* Ticals 1000. † Ticals 800.

and obtain an advance of money, which is then worked off by them in tin-streaming, the ore being sent down to the raja at a price previously agreed upon between them. The output of tin per month, or even per year, depending as it does on the amount of rainfall, the state of the communications, the prevalence of fever, and the labour of the people, who are probably the least industrious on the face of the Earth, is at best a fluctuating quantity. In a good year it probably amounts to 700 pikuls, or over 40 tons, and in a bad year to less.

Besides fish and tin, Langsuan produces large quantities of the various kinds of fruit which are common to most Malayan states—the durian, the fame of which you have doubtless heard, the invaluable papaya, the mangostin, mango, orange, jack-fruit, melon, banana, and many others. But the moist climate has some disadvantages, and the people at the mines, especially the unfortunate Chinese, were all soaked in malaria, and were suffering from abnormally congested spleens and livers. Surer death-traps than many of these places, sunk deep in the damp forest gloom, it would be impossible to find. Ticks, leeches, and blood-sucking flies, in countless numbers and of unequalled voracity, also conspire to vary the monotony of life.

There lives in the dense jungle a peculiar plant known to botanists,* but possibly not known to you, which is called by the Siamese *kalang-ton chang*, and which sets up great irritation in the skin of any person coming into contact with it. It has a large broad leaf, and the Siamese declare, after being badly stung by it, the only remedy is the heat of a fire; to bathe in a stream, which is the natural impulse, is considered absolutely fatal. A spot on the Kra-Champawn trail is known as *Burma-tai*, from the fact that a party of Burmese, coming across to harry their neighbours in the old fighting days, are said to have got into a thick growth of this plant, and to have bathed in the stream to allay the agony, with the result that they all died there. A second species,† called *samkao*, is supposed to be not so violent in its effect. We met the plant in many parts of the country, and our mahouts constantly warned us to beware of it as we brushed through the jungle.

The amount of padi grown in the state is, owing to the general absence of land suitable to it, insufficient for the population, and rice therefore forms the principal import, other articles imported being opium, and piece goods in small quantities.

On returning to the boat, some of us succumbed to the old enemy, fever, as a result of the drenchings from the rains which we had experienced inland, and the boat resumed the hospital-like aspect with which we used to be so familiar on the Me Kawng.

Our next destination was Chaiya, a day's sail to the southward

* The fever or devil nettle, *Urtica crenulata*.

† *Urtica heterophylla*.

The coast is a low sandy one, with a few grand limestone outcrops, and a fringe of wicked coral reefs some distance off it. Inland the big forest trees stand gaunt and dead, waving their bare arms over the dreary creeks and backwaters, which form the highways of the Malay fishermen.

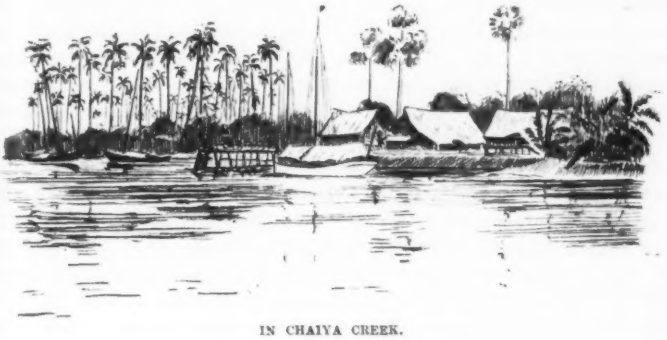
Approaching the Bandon bight about ten at night, we were preparing to anchor close in under Lem Sai, when the suddenly shoaling water compelled us to run out from the land. In so doing we suddenly grounded on hard sand. Fortunately the wind was westerly and the water smooth, but all attempts to get off were unavailing, as the tide was falling. Lem Sai bore W. 5° S. 2 miles from us, and there was a wide channel between us and the point. The banks lay off half a mile further to the east-south-east in three ridges of hard sand. Though not marked on the chart, they may prove very dangerous to vessels making the bight from the north. We ascertained subsequently that all the banks on the coast undergo some considerable change every north-east monsoon season. During the four months from November to February, when it is at its height, a heavy sea runs perpetually on the coast, and the water is piled up along it, so that the depth on banks and the bars of the rivers is temporarily increased. The deposition of material, however, goes on with constant regularity, and further south has wrought remarkable changes in the configuration of the coast. Fortunately the wind remained light, and blew directly off shore. In the afternoon we got off with the flood-tide,* just as the wind began to freshen up from the south-west.

The charts of the Bandon bight show it to be a vast shallow expanse, with scarcely more than 2 feet of water at low water. We had, however, been informed that a channel exists by which Chaiya may be approached, and that the governor had placed marks along its southern edge. We picked up the outer one with some difficulty, and beat up against half a gale of wind. We found the channel to run north-east and south-west, and to be from 300 to 400 yards wide, and we found $1\frac{1}{2}$ fathom of water on the outer edge at low water, rapidly deepening to 3, 4, 5, and finally 6 fathoms. The anchorage is off a sandbank, which makes a splendid mark in all weathers, appearing of dazzling white colour, even at a distance of 6 or 7 miles; the mirage often makes it visible at a greater distance than otherwise would be possible. From here the entrance to Chaiya, or Pumriung, as it is locally known—the Pumring of Crawfurd—lies about 2 miles N. 23° W. There is 10 feet over the flats in the channel at high water, and $2\frac{1}{2}$ fathoms inside the

* In the Gulf of Siam, as in the Gulf of Tongkin, for the most part of the month the two diurnal tides are unequal, the inferior tide disappearing for some days almost entirely, with the result that until the new tide is born there is only one tide-wave in the twenty-four hours.

river, where a vessel may lie protected from all winds. It, however, took us a whole day to get in, as we had to sound and survey the channel first of all, which involved many hours' work in the skiff, and the sea on the flats when it is blowing hard is not in favour of taking bearings from a small boat.

The scenery of the bight is quite peculiar. At low water immense tracts of mud and sand are laid bare, for the edification of flocks of pelican, cormorants, and herons. As the tide comes in, the whole becomes a boiling mass of foam, and an uneasy little sea gets up, with a short, uncomfortable motion. The birds betake themselves to the far-off shores, and a few boats come out and cut across from creek to creek. As the water falls again it becomes smoother, and long fishing-canoes



IN CHAIYA CREEK.

come out, their Malay crews wading with their seine nets along the sands. Far to the southward dense masses of vapour condense about the summits of the Lakawn range, at a height of from 5000 to 6000 feet above the sea.

CHAIYA.—The *muang* lies a few hundred yards up a small creek west of the main stream, and we lay off the governor's landing, where stacks of firewood, boat-building and fishing sheds, rows of palms, neat paths, and charming grass-plots showed by their unusual tidiness that the governor must be no ordinary one. Praya Chaiya was away, but it was characteristic of him that, hearing of our arrival, he came across the Bandon flats in the most violent weather, and arrived unexpectedly with a couple of men late one night. A more excellent companion or a kinder-hearted friend I never met among the Siamese. He had a fund of information on the natural history, meteorology, and every subject connected with his charge; he had decided notions of the value of cleanliness in a town, and was a wise and energetic ruler, with a remedy or sensible experiment for every evil; and he was a keen yachtsman and a shrewd man of business. For many years he has been the lessee of the

birds'-nest farm from the Government, and no industry is more full of excitement and adventure.

The edible bird's nest is formed by a swiftlet, known as Peale's swiftlet (*Collocalia spodiopygia*); Horsfield's swiftlet (*C. lichi*), *C. esculenta*, and *Hirundinapas Indicus* have also been credited with being the architects of these nests.

The birds build in great numbers on the precipices and in the caverns of the steep islands of the limestone series which form one of the characteristics of the gulf, and fragments of which occur at Mergui, on the west coast, in the Malay archipelago, and in Tongkin. Each of the islands under Praya Chaiya has a guard of men upon it, living in small cottages high up in some nook of the limestone rock, like a Norwegian hut, or down on the spotless sand of the single little cove, beneath a palm or two. The collecting of the nests is effected by these men three times in the year: in the hot season, and at the beginning and end of the rains. Great care has to be exercised that the nests should be taken at the moment when the birds have just finished building, and before any eggs are laid, for if this has happened the birds are said not to build again.

The collection of the nests is risky, owing to their inaccessibility, but it is profitable, owing to the high prices they fetch,* and not a little poaching is indulged in by the crews of the boats navigating the gulf. The consequence of this is that the guards are all armed, and open fire on any boat they see approaching their island nearer than 100 yards without further explanation being needed; and many a boat blown off the land, and sorely in need of shelter or fresh water, has to shear off again with a little extra ballast on board in the shape of buckshot or snider bullets.

The annual rent paid to the Government by the nest-farmer is over £2000, and the upkeep of the fleet of guard-boats costs over £1000 a year.

In Leale's time (1827) the population of the province was put at 19,000. It is now about 43,000, of whom nearly half are Malays, who retain their customs and a smattering of their religion, but have entirely lost their language. The Siamese still call them *Puek Malayu*, but, except in the build of their long low boats and their dislike of pork, they have few of the characteristics of their ancestors. They live in separate communities about the coast, and the men do the fishing and the women the weaving, the looms being beneath the houses, as in the Lao states. There are also a few hundred of the aboriginal negrito tribes inhabiting the dense forests inland. Praya Chaiya has done his best to overcome their extreme timidity by kind treatment, and has prevailed upon them to come in occasionally to the town to barter. Like many of the

* About 50*s.* a pound for white, and 25*s.* to 30*s.* for the inferior or red-coloured nests.

Ka tribes of the North Lao states, they wear little clothing, and suffer greatly from skin diseases, owing largely, doubtless, to poverty of diet. Cholera and Chinamen are almost unknown in Chaiya, one of the few places where these plagues are absent.

The province suffers from want of navigable streams, and neither tin nor timber can at present be brought out at a price which will pay, the experiments made by the governor with elephant transport having so far ended in dead loss.

During our stay at Chaiya, where we were obliged to wait some time to recover our sick men, I overheard a rather interesting conversation among the people who came round in the evening to see and talk to us. They were discussing among themselves these English, and comparing them to the French and Germans. They concluded that we were the worst drunkards, but the best traders of them all. One fellow drew a series of rough plans in the dust, and pointed out how shrewd was our occupation of such points as Gibraltar, Malta, Aden, Singapore, and Hongkong. He dilated on the greatness of India, and he questioned the wisdom of allowing France a free hand in Madagascar, on the flank of South Africa. His knowledge of the colonizing enterprises in which the European powers were engaged in various parts of the world, and the success they have met with, was most remarkable, and I asked him next day where he got his information, for he was a mere peasant, and had hardly ever been outside the province. "Oh," said he, "I found an old book of maps at Chao Kun's (the governor's), and learnt from that;" and he had actually taught himself to read English from an atlas. "Oh yes," remarked Nai Suk, who was listening, "geography teaches every kind of knowledge." I did not, of course, tell them what struggles the President and Council of this Society have had to persuade educational bodies in this country of the same fact; their respect for our education would have received too severe a shock.

Bandon.—Bandon, the next province southward across the bight, was long a part of the powerful state of Lakawn, but for very sound reasons the Siamese Government has, for administrative purposes, restored it to complete independence of that state, in the same manner as on the west coast it has removed several small districts from its rule.

The population numbers about half that of Chaiya, and is composed for the most part of Chinese from Hainan, Hokien, and other places, many of them imported direct by junk. They are engaged in exporting jungle produce, such as rattans, skins, and horns, and quite a fleet of junks sail out of Bandon in this trade. Although, owing to the shallows, the Bandon river is difficult of access for vessels drawing more than 6 feet, the river itself forms a magnificent waterway, which should play a great part in the future development of the country. Looking at the map, you will see that the main axial range of the peninsula, which comes down from the Shan states, is at this point very far over to the

west, and is dwindling to a comparatively insignificant altitude, until it disappears at the southern end of Junk Ceylon, or Puket island. In the mean time, a fresh, almost parallel ridge of granite begins to appear in the islands of Kaw Pungunn and Kaw Samui to the eastward, and is continued southward by the Lakawn range, which henceforward becomes the backbone of the peninsula. It is the whole of the intervening space between these two ranges, constituting Bandon and a large part of Lakawn, which the Bandon river drains to the sea. Of the two main branches of the river, the right or eastern takes its rise within comparatively few miles of the Bay of Bengal, where the watershed is so low that it is stated by the people a four-*chau*, or four-oar, boat can be taken right across with a very short portage to the upper waters of the Trang river, the total distance to Trang being 170 miles. Certain it is that the old trans-peninsula route, mentioned by Crawfurd and others, lay across the watershed from Pang Nga* and the Paklao stream to the Bandon, and down to Punpin, which is on a creek on the borders of Chaiya and Bandon, and a favourite residence for the governor, who is from there able to direct affairs in both provinces.

On leaving Chaiya, strong winds carried us to the passage between the archipelago and the northern termination of the Lakawn range on the mainland. There are two quite distinct groups of islands, the western or Angtawng group being a continuation of the distorted limestone outcrops on the flanks of the granites; and the eastern, comprising the important islands of Kaw Samui and Kaw Pungunn, being the true extension of the granites of the Lakawn range. The western group being the breeding-place of large numbers of swiftlets, comes under the nest-farmer. Kaw Pungunn belongs to Chaiya, Kaw Samui to Lakawn. The former is inhabited by Siamese fishermen, and has in its day produced a little gold and tin. The latter is inhabited by some hundred Chinese, who cultivate the coconut palm and rear large numbers of pig and buffalo. The trade of the island is entirely in the hands of the Bandon junks. There is some tin in the hills, but, owing to lack of sufficient water-supply, it has not been worked with success. The ranges cut the island effectually in two, running from the north-west corner to the south-east at a mean elevation of about 2000 feet, and are clothed with dense forest, which render communication between the two coasts impossible except at one or two points, and consequently the villagers generally communicate along the coast. It is curious that fever is very prevalent, and cholera by no means rare.

Under the lee of the Lakawn range we had calms and light airs and squalls. When nearing Lakawn bight we stood out to sea, to clear the shoals off Lem Kolam Puk. We were now among completely new surroundings; the *rua pet* and *rua chalom* of Siamese waters were no

* The Phoonga of some authors.

longer to be seen, and the long low Malay types of craft became common. The banks off this headland, as well as the shoals and mud flats within its embrace, are silting up rapidly.

In his book on Siam,* Mr. F. A. Neale gives a distinct account of his passage "through the channel between Ligor (*i.e.* Lakawn) and the island of Pulo Tantalem" in the *Victory*, a frigate of 1400 tons, across what is now known as the Tale Sap, or inland sea, past Patalung to Sungkla, or Singora. Now, fifty years later, no boat drawing more than 2 feet can cross the Lakawn bight or navigate the waterway known as Klong Ranawt, which communicates with the Tale Sap. From Lakawn to Singora the coast-line stretches its unbroken barrier of spotless sand, and behind it the reeds and grasses of the vast swamp land known as *Tung Ranawt* whisper in the wind to the far horizon. In old maps this piece of country figures as Pulo Tantalem, but the name is unknown locally, and the wide waterway generally depicted between it and the mainland does not exist. The view across the Tung Ranawt from the top of the sand-dunes thrown up by the monsoon is most peculiar, and wild and dreary in the extreme. The plain is inhabited by a small breed of elephants known as *chang deng*, owing to the reddish colour of the bristles. These animals, largely owing, no doubt, to their peculiar diet and the brackish character of the water they drink, seldom grow to a greater height than 8 feet, and have unusually small heads and large bodies. They are very wild, and much given to marauding expeditions on their neighbours; they have "let in the jungle" on all would-be settlers with such success that hardly a house is to be seen. None have ever been successfully tamed, owing to the fact that the change of water incidental to removal to the neighbourhood of Lakawn or Patalung seems to affect their health, and they do not long survive. Both men and animals in Siam are, so far as I have observed, very susceptible to a change in the water. The plain-dweller absorbs with immunity what he amiably terms "water," whatever its consistency and flavour, and drinking the cold clear mountain streams of the hill country is as fatal to him as the viscous fluid of the plains is to the mountaineer or the foreigner.

Singora.—It was with no small pleasure that we rattled down the anchor in Sungkla, the furthest point in our voyage, and contemplated the beautiful hill-girdled harbour that lay before us. In coming south we had set back the seasons, and the rains had not yet commenced; the shore party returned from market laden with fruits which were long ago over in Bangkok. The hot blue sky was reflected in the water, and junks and Malay luggers came and went to the light sea-breeze. Occasionally, to clear the air and test our cables, a furious squall swept down upon us from the hills. Junks went adrift and

* 'Narrative of a Residence in Siam.' By F. A. Neale. London, 1852.

drove on shore, or mowed down whole rows of fishing-stakes, and their crews shouted at one another, and looked on, as is the helpful way of the Celestial. We watched the anxious skipper hesitatingly suggest orders in his most persuasive tones, and we saw the crew, who had been busily wrangling together, turn like one man upon him with a howl of execration; truly the experiences of a junk captain must be exciting and peculiar.

Singora was seized at the beginning of the century by a party of Chinese from Amoy. They were long-sighted enough to immediately place themselves under the protection of the Court of Bangkok, which for various reasons found it convenient and desirable to have a Chinese colony situated alongside the powerful state of Patani. The lustre of both 'Tani and Lakawn has gradually been dimmed,

ENTRANCE TO SINGORA.

and Singora, happily situated as it is on the only really protected harbour on the coast, and at the entrance to the inland waterway of the Tale Sap, has attained the position of the most important centre on the whole east coast. The population of the town, and suburbs across the water, is over 10,000, partly Siamese and partly Malay. It is curious that, although the government and trade are entirely in the hands of Chinese, and their influence is evident at every turn—in the craft in harbour, and in the houses and the architecture of the walls ashore—there is yet no Chinese coolie class.

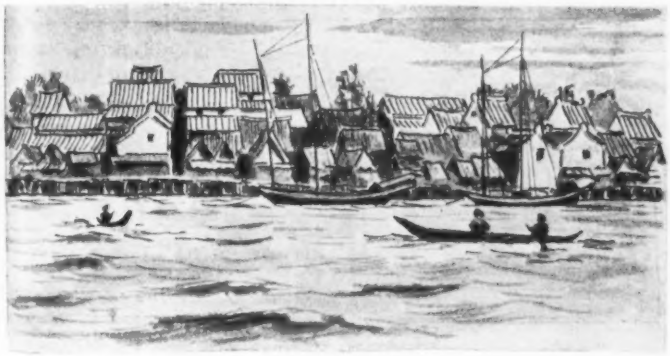
There are some 60,000 people in the province, scattered in small communities along the coast-line about the shores of the Tale Sap, and in the jungle of the interior. The chief exports are rice, tin, fish, and skins and horns, and the trade is sufficient to keep a considerable fleet of junks trading with Singapore and Bangkok, and a number of Malay craft sailing to the Malay states on the south.

Before going up to the mines we had to wait a few days in Singora, owing to the fact that the king was expected to call in on his way back from Java. When he arrived he came on shore, and walked round the town in his brisk way, noting the various improvements instituted by

the commissioner, and recognized many old friends among the people. His Majesty professed to think our craft small for going long distances, but I believe he would have dearly loved to sail back to Bangkok in her himself.

Pra Vichit, who will be remembered by many in this room as having been for some years at the Siamese Legation in London, was at the time commissioner in Singora, and, although he had only been there about a year, the changes he had wrought, and the popularity he enjoyed among the people, showed that he had devoted himself to the difficulties of his task with ability and success.

The tin-mines lie in the hill ranges south and west of the town. I need not weary you with many details, for they are worked in much the



SINGORA, HARBOUR SIDE.

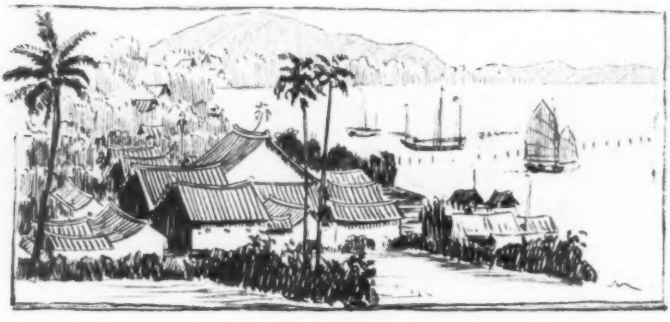
same fashion as at Langsuan, and with much the same results, namely, a small and ever-varying output of tin, at the expense of much sickness to the miners. I obtained some of the most beautiful crystals of cassiterite I have ever found: the men regard them with some awe, and take sufficient interest in them to keep a few as curiosities. Mining is, unfortunately, seriously interfered with in some districts by the spirits. We came upon one very rich hill-working where the men had been served with a summary notice to quit in the shape of the death of eight men from fever in three days.

The agricultural people of the province are all Siamese, and a finer, healthier-looking set of peasants I have not met in any part of the country.

The dialect of this neighbourhood is often almost unintelligible to those accustomed to Bangkok modes of speech. The nasal twang noticeable on the west coast is very pronounced, but perhaps the most curious feature is the tendency to abbreviation. Here we have the

disintegration of words which has given rise to the monosyllabic languages in actual process of development, e.g. *'San*, for *Kao san*, padi; *'Lung* for *Patalung*, the name of the town; and instances might be multiplied.

Among the hills the last fires of the *rai* clearings still smouldered, and the heavy brown smoke caused atmospheric effects which were very charming and homelike. The intense clearness of the air, which is the usual condition of things, makes one of the chief characteristics of the tropics, and the contrast was grateful. The destruction caused by the indiscriminate burning of the forest is, however, very great. After two or three crops the ground is forsaken in favour of a new clearing, and the bamboos and long grasses immediately spring up, choking down the valuable seedlings, which have no chance of life. The result is



SINGORA STRAIT.

that in many parts of the province the place of the large timber has been entirely usurped by bamboo, or *lallang* grass, which it will be almost impossible for the planter of the future to eradicate.

The red loam of many parts of Singora is admirably adapted to both pepper and coffee, but the absence of any labour laws, and the impossibility of getting or controlling labour, have so far told against success. It is very desirable that the Siamese Government should give its attention to these matters.

Our camps were disturbed considerably by one of our elephants, who was a bad sleeper; if he found no comfortable undulation for his pillow at night, he slept not at all, and became very crusty in consequence.

It is somewhat interesting to compare the weights carried by elephants in the tin-producing districts of the Malay peninsula with those used in the long journeys and mountainous country of the Lao states. In the peninsula the distances are seldom more than at most three or four days' march, and the elephant is expected to carry as much as 900 to 1000 lbs. besides his mahout and howda. The latter is often

a mere brace of panniers, slung together so as to rest one on each side of the backbone, and covered sometimes with a light barrel-roof of bark. A good tusker carrying his 9½ cwt. will fetch about £56, and a female which can bear 8 cwt. is worth about £45. In the Lao states, where journeys of ten days or three weeks are frequent, the average weight hardly exceeds 300 lbs., or one-third of what is usual in the peninsula. The prices in various parts of the country vary considerably. When we were on the Me Kawng and in Muang Nan in 1893, a good tusker could be had for £32, and a female for £24; at Chieng Mai, where good teak-hauling elephants are in great demand, a tusker may fetch £150, and a female anything from £50 to £100, according to her strength and ability.

In the Siamese Malay states there are probably about 1000 domesticated elephants, all told, and in the Lao country probably over 2500 animals are working at the present moment. That these animals breed in captivity in Siam is due to the fact that a large number of them spend the greater part of their time holiday-making in the jungle. When there is no work for his beast, the mahout takes him out to a nice cool green bit of forest, and leaves him there to enjoy himself. There is no expense connected with his upkeep, for he looks after himself. He has a hobble of rattan round his feet to dissuade him from wandering too far, and a wooden bell round his neck, by the tone of which the mahout or his little boy can always find him, when they go out once a month to look him up, and give him some bananas.

The Inland Sea.—On our return from this trip we started for Patalung. We had one of the long dug-outs which are generally used for navigating the Tale Sap, and a crew of so-called Malays. Like the people of Malay origin in Chaiya, they have lost their language and most of the best qualities of the true Malay. They had a most unseamanlike love of dry land, and when it was time to start every man appeared to possess a dead or dying relative whom it was imperative to attend. The very high death rate was, as I suspected, due to the gale of wind that was blowing. Where the mere Western lamely pleads a "previous engagement," the Oriental revels in a harrowing and wholly imaginary account of disease and death, which has the advantage that, while no one believes it, it provides a field for the exercise of his unequalled powers of invention, and an excuse for a display of a little flowery rhetoric. When, later on, we set out from Patalung to return under somewhat similar conditions, reference to their dead and dying relations had no power to entice them on board, and we had to begin to get under way without them before any of the crew could be induced to overcome their dislike of wind and water.

In the open water of the Rat Pumi at the southern end, the tidal influence coming through Singora strait is felt, and with a strong wind

a lake boat may have a roughish time. At Pak-raw, however, there begins a system of intricate waterways winding between long jungled islands, known as Kaw Yuen, Kaw Nung Kumm, and Kaw Mak. Two main channels lead northward to the inner portion of the great lake, that to the west being the narrower and deeper, with, at this season of the year, little more than two fathoms. At Pak-cha, and at Pak-payun, where the lake once more opens out, a few villages are passed, standing on piles above the surrounding water. Like the harbour at Singora, the surface is everywhere dotted by fishing stakes and traps of mysterious and intricate design, as troublesome often to the guileless mariner as to the unsophisticated fish.

Pak-payun is a pretty strait between low hill ridges, and on the northern horizon of the open water the lofty outlines of the limestone islands stand up abruptly. This group is known as Kaw Si Kaw Ha,

ON THE INLAND SEA.

and is a favourite building-place for the swiftlets, although, owing to its comparatively small size, the production of edible nests from there is not as large as that from the Angtawng group.

There is a statement in Prof. Keane's 'Eastern Geography,' apparently on the authority of some travellers whose names are given, that the islands of the lake are inhabited by a tribe of troglodytes, or cave-dwellers, who live by collecting the nests in their rocky dwellings. We made studious inquiries on the subject, and I can only presume that the popular belief in the existence of *nats*, or spirits, which are supposed to inhabit these islands, as they are every stream, hill, and tree, was in some way so mistranslated to the travellers that, coupled with some facts about the people employed by the nest-farmer on the islands, it took in their minds this highly sensational form. It is a thousand pities to destroy so pretty an illusion, and we felt distinctly the poorer mortals for not being able to retain it.

On reaching Patalung, we were able in some measure to judge of the rapidity with which land is making in the neighbourhood. Where Neale notices "a fine creek or river off Talung," there is a reedy promontory standing out a quarter of a mile into the lake, through which trickle a couple of sluggish streamlets too shallow to float a boat drawing

a foot of water. The lake is 2 feet deep for a mile out, and with the addition of the flood waters of November, December, and January, the depth scarcely exceeds 9 feet anywhere, even in the channels.

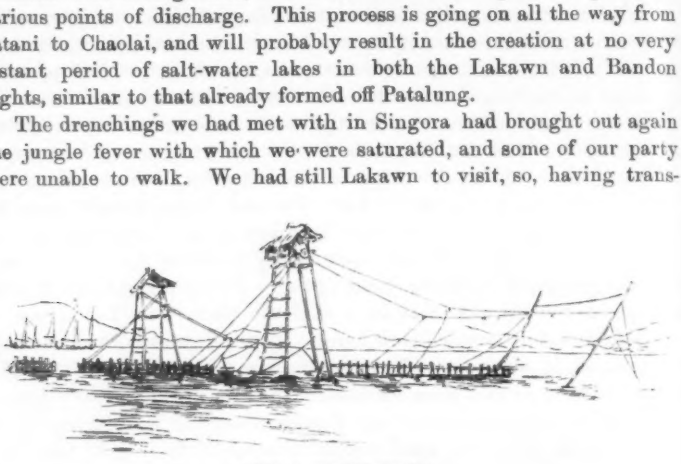
Patalung was a great emporium in the days of old, with deep water approaches right in. Now it is a small agricultural village, completely retired from the world, where there are no vehicles, no transport animals, and no Chinamen, and where no decent-sized boat can approach. No wonder the natives have curtailed the name to a single syllable. There are probably under 40,000 people in the province, but it is a great fruit and rice growing country, and should have a future before it.

The great barrier bank of Kaw Yai and Tung Ranawt may be supposed by the unlearned to have been cast up and formed as we now find them by the slow and painstaking efforts of the forces of nature. But the people of Patalung know better. In the days when it still lay open to the sea, protected by a sand-bar where Kaw Yai is now, a virtuous and holy couple lived here. They had one boy, who one day disappeared, it was supposed as a stowaway on board one of the big junks which went and came continually. Years after, a great Chinese junk, gilded and flagged, put into Patalung, and in the great mandarin who came on shore the aged couple recognized their long-lost son. But he, in the pride of his heart, cast them off disdainfully, and would have nought to say to them. The two old people fell on their knees and prayed that ruin should fall on him that he might learn humility. And it became very dark and a great storm arose, and the ship went down with all on board, and the chests and trunks of valuables were washed hither and thither, and now remain as the banks and islands which form the Tale Sap—a warning to all undutiful sons. Parents here may find the story useful. This tradition bears out the evidence afforded by history, and by a consideration of the physical geography and geology of the district, of the comparatively recent date of the formation of the present barrier-bank, and the rapid silting up of the salt-water lake, which is now going on at the rate of some 2 inches a year abreast of Patalung. The story no doubt had its origin in some specially violent cyclonic storm, such as visits these seas three or four times in a century, or in some unusually violent monsoon season, which may have left traces of a very permanent character in the configuration of the banks. Such an event would be very likely to be chronicled in a legend of this kind. The coast is out of the general track of the cyclonic disturbances in the China sea; but within the century three or four such storms have visited different parts of the shores between the fifth and eleventh parallels, and every north-east monsoon season effects changes in the outlying banks of the river-mouths, as mariners relying on the '74 charts find to their cost.

While the rivers are bringing down their vast burden of sediment with each rainy season, which is able to work effectively on the largely

decomposed granites of the interior, the violence of the north-east monsoon, impinging directly on the coast, prevents the dissipation of the material over a large area, and forces it back and piles it up at the various points of discharge. This process is going on all the way from Patani to Chaolai, and will probably result in the creation at no very distant period of salt-water lakes in both the Lakawn and Bandon bights, similar to that already formed off Patalung.

The drenchings we had met with in Singora had brought out again the jungle fever with which we were saturated, and some of our party were unable to walk. We had still Lakawn to visit, so, having trans-



SINGORA FISHING STAKES.

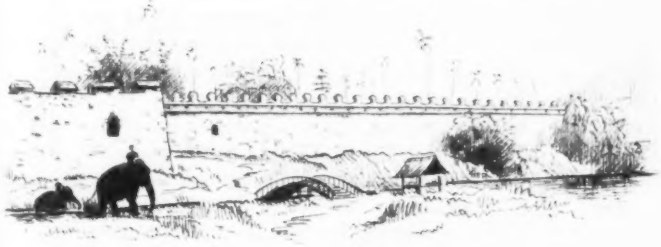
acted our little business with the governor, we returned to Singora, and in a few hours after our arrival were under way once more.

Lakawn.—Arrived in Lakawn road, we anchored, and, leaving two hands on board, started in the skiff up-river for the city with a week's stores. I felt somewhat nervous at leaving the boat in such an exposed anchorage. There is only 2 or 3 feet in the bight, and so it is impossible to get a boat into any of the creeks there, and there is no shelter, as the map shows you, for 60 miles in any direction. However, the squalls under the lee of the mountains in the south-west monsoon are nearly always westerly, and to guard against damage from the north-west squalls the junks have a confiding habit of anchoring on the mud in 3 feet of water, relying on the pacifying influence which the mud bottom exercises on the sea. It is a charmingly Oriental kind of seamanship, but, like most things Oriental, not without reason.

Lakawn is, in its way, the most striking state in the peninsula. Here are the remains of an old Hindu influence which at one time dominated all the surrounding states. Where our boat now scrapes across the sand bottom of the tortuous stream, the ribs of old junks that once went up and down the river lie embedded in the bank. Hamilton* mentions the vast numbers of the pagodas in the town, and the Dutch factory which stood below; but he was before the time of Alawng Pra,

* 'A New Account of the East Indies.' London, 1744.

and Harris, who came after him, comments on the destruction wrought to the town and province by the Burmese wars.* He found that about 12,000 men only were borne on the conscription rolls. Now there are 133,000. It is, in fact, the most populous, the largest, and the richest of the Siamese states of the peninsula. And yet, owing to the exposed character of the road and the insignificance of the shallow winding stream which forms the only approach from the sea, it has been very little visited. It is a five hours' pull to the city landing, and for the last few miles the stream is about half the width of this table.† If you look at the map, you will understand how it is that when one enters Lakawn one finds one's self completely outside the influence of the modern world. The province has practically no outlets, and whereas the west coast, and places like Chaiya and Singora, are occasionally visited by



LAKAWN WALLS.

steamers, the people of Lakawn have only heard uncertain rumours of their existence.

In the old days Lakawn held sway over Krabi, Kiriwong, and Bandon, thus touching the sea on the west coast and on the Bandon bight. At neither point are the harbours very serviceable. The east coast, as already pointed out, is either an exposed sand beach or a series of shallow mosquito-clouded mud swamps. The province is cut in twain by the lofty range of hills referred to above, and by far the greater part of the population and of the arable land lies behind that barrier. There are four possible outlets for its produce—north by the Bandon river, west to the magnificent harbour of Kopa, south to the Trang river, or east across a low pass to Lakawn. The last is very unsatisfactory, as it is itself hardly get-atable, and in the north-east monsoon the coast is practically closed to navigation. When I was at Singora, Pra Vichit was considering two schemes—one for dredging the Klong Ranawt so as to keep open communication with the sheltered waters of the Tale Sap

* 'Account of an Overland Journey from Ligor to Bankok.' Madras, 1854.

† About 15 feet. The fishermen estimate the rate of deposition on the bar of the river to average 2 to 3 inches a year.

and Singora during the winter season; the other for opening up the old overland route to Trang, which is mentioned by Captain Low.* On the whole, the latter will probably be the most feasible and the most useful to both portions of Lakawn.

The governors of Lakawn have ever been very independent gentlemen. Harris says, "There are three or four commissioners sent to Ligor by the Siamese court, but the chief treats them with very little consideration, and they exercise, except on occasion of his absence, no authority whatever." † Relying on the inaccessibility of their capital, they have treated Bangkok authority with a high disdain, which has resulted in their being left too much alone. At the time of our visit we found the governor in every way maintained the traditions of his ancestors.

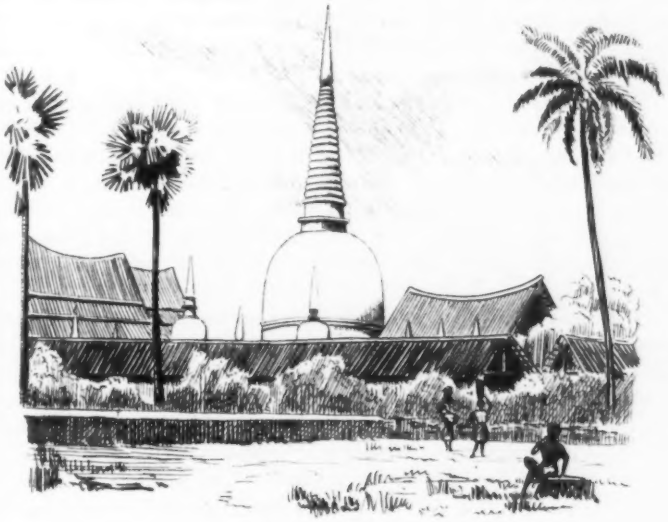
It would, however, ill become me to abuse the chief; he was affable and even friendly. Nearly every other governor I had met had more or less betrayed a conviction that I was mad, based on the fact that they did not understand travelling in a seven-tonner. Whatever Praya Lakawn thought, he refrained from all comments. It was also to his credit that he knew more about his state, its geography and products, than any other chief except Praya Chaiya whom we had met; and while, of course, concealing a good deal which we were not desired to know, he gave us much interesting information. Information, whether geographical, commercial, or of any other kind, is, in a state like this, less easily obtained than you would suppose. First of all, there are no statistics. Then the chief, to whom you naturally appeal, intends that you should know as little as possible, and he has even given strict orders to his subordinates that he alone is to give you information. The consequence is that you leave his house with an accurate knowledge of the habits and failings of all his neighbours, and a hazy idea that he is the most just and most able ruler in the world. The subordinates bring you presents and tell you where the snipe lie or the *sambur* feed, but the moment you ask them anything about the export of deers' horns, they find they must be gone. You pump the Chinese traders, but they have been told by the governor that all you are after is to set up a business in the place—and they become mute as only Chinese can. The Malays discuss their fishing prospects with gusto, but when you ask about freights, or the depth on the bar, their answers range over a long list of possible figures in that royally vague manner which so becomes the Eastern. The Siamese know their chief too well to say a word more than the laconic "don't know," which is next to the more frequent "cannot," the most irritating dissyllable in the Siamese language. It would take too long to tell

* *Jour. Asiatic Soc. Beng.*, vol. vii. part ii., 1838.

† 'Overland Journey from Ligor to Bankok.'

you how one by one Nai Suk, the boys, and I walked about the country, and dropped in here, or drank tea there, smoked in the *sala*, or gossipped in the market, and how we put our notes together and compared and averaged our total. Yet such often was the way, and even our official passport did not always obtain more for us than fitting civility from the chief.

The approach to the city down a long avenue of banyans and peepul trees, which flourish about the spacious enclosures of endless ruined *wats* and pagodas, is distinctly impressive, and reminds one far more of India than of Siam. This effect is heightened by the local



THE LAKAWN PAGODA.

custom of carrying loads upon the head instead of slung across the shoulder. In Siam generally the head is regarded with a certain veneration, and no loads are ever placed upon it, nor is the hand allowed to rest upon it in blessing, as may be done with children in the West. Yet in Singora and Lakawn country folk bring in their market produce piled in innumerable baskets on the head to a height of sometimes three feet. In this manner even women and children carry weights of 80 lbs. for many miles. A group of these people, who are generally taller and slightly darker and better looking than their sisters in Upper Siam, forms a very striking picture.

The features of the city are the massive red-brick walls which encircle it, and the great pagoda, the resort of thousands of pilgrims, which has the miraculous power of casting no shadow. The interior of the walls

is slightly disappointing—ruined pagodas divide the space with palm plantations, beneath which the usual bamboo dwellings nestle. The governor's house is larger, but little cleaner than the rest; the market-place is a small clearing in the centre of the town, where a few hundred sociably disposed persons congregate in the cool of the morning. For the rest of the day the by-ways are given over to goats and elephants, who, whenever they meet, stampede in various directions in mutual fear of one another.

There is a considerable population of Malays in Lakawn, who, unlike those at Chaiya and Singora, retain not only their speech, but the *kriss*, and with it their pride of race. They maintain constant sea communication with Kelantan and the Malay states to the south, and are a fine lot of people, and handle their boats, men and women, in a manner which excited our highest admiration.

The Chinese form the traders and miners of the state, and are very jealous of Europeans. The mines at present in work are all situated in the Bang Ron valley at the foot of the hills, about a day's journey to the south-west of the city. Harris states that the tin was in his day said to be exhausted, yet in the last sixty years the whole of the Ron valley has been turned over to a depth of between 30 and 40 feet, and many thousands of tons of tin taken out and exported to Bangkok for the China market.

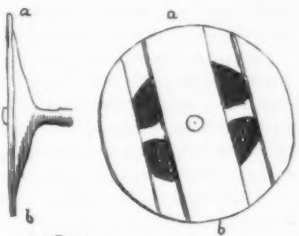
We found some four hundred men at work in the valley, which presented a curious scene with its white, shining mountains of tailings, tumbled in wildest confusion in all directions. Only two spots stand above the surrounding waste—one a grove of palms about a *wat*, or monastery, and the other a lonely spot where stands a tall gaunt forest tree or two. This belongs to a very ill-tempered landlord, who has persistently refused to sanction work on his ground on any terms whatever. He has been offered a high rent and untold bribes; but sacrifices, offerings, and prayers have had no effect, and the last gang of men, who thought they had come to terms with him, were turned out summarily after losing half their number by death. He is the spirit who inhabits one of the trees, and he is spoken of in whispers even down in the village.

The tin sand in the valley seems now to be very nearly worked out, and efforts are being made to open up new districts along the hills further north. The mortality in the uncleared jungle is, however, so heavy that, with the present high royalty of over 16 per cent. demanded by the Siamese Government, the *taukes*, or headmen, declare they cannot make them pay; and there seems every likelihood, if the royalty is not lowered, that this industry will dwindle to very small proportions.

The coolies are the wildest possible creatures imported by junk direct from Kwang-tung and Hainan in China. Great crowds came to see me as a curiosity; they were astonishingly friendly, but their

manners were most uncouth and barbarous, and contrasted strangely with the refined bearing of many of the Siamese of Lakawn. I was much struck with the simplicity and lack of guile among the latter. They have seen less of the *Farang* than many of their countrymen in Upper Siam, and have not, therefore, reached that point of their existence when they must become acquainted with the vices of the West—the most dangerous ordeal through which a native race has to pass.

It is remarkable that in a state so largely agricultural there should be absolutely no kind of vehicle in use. The *kwien*, or jungle cart, of Upper Siam is unknown; not even sledges are used. The only beast of burden is the elephant; even the buffalo is only used for ploughing and threshing out the corn. One would naturally infer that the people were unusually uncivilized, yet in their architecture they have in the past known no small skill and taste. The only exception to this absence of vehicles is in the carts used by the Chinese tin merchants to carry the tin slabs from the smelting-house to the water-side. They are of so primitive a kind, however, that an up-country Siamese would be ashamed to use them, and it is not surprising that they have not been more adopted.



Wheel, Lakawn tin cart

With our return voyage I need not trouble you. We had heavy squalls in the Bandon bight, and called in at Chaiya for mails. We experienced a gale of wind off Champawn, and the tempest-breeding peaks of Sam Roi Yawt did not spare us. And then at last, one wild lurid morning, as the sun struggled up upon the monsoon-laden horizon, the big following seas bade us farewell, as they broke in roars under our little ship and hurried us on their foaming summits into the smoother water of our old friend the Menam Chao Praya, or Bangkok river.

Before the reading of the paper, the PRESIDENT said: The paper this evening will be on the journeys in the Siamese East Coast States by Mr. Warington Smyth. We have already had in this room two very interesting papers from Mr. Warington Smyth, one about four years ago, when he described to us the upper Mekong and his visit to the sapphire mines; the second one when he gave us an account of his descent of the Tenasserim river, of the pearl fisheries, and the Kra peninsula and its tin works. On both occasions the meetings were large, the papers were listened to with great interest, and there were most valuable discussions, in which Mr. George Curzon, Lord Lamington, Sir Dietrich Brandis, Mr. Annan Bryce, and others joined. We have now the great pleasure of welcoming Mr. Warington Smyth in person. We are honoured this evening by the presence of His Royal Highness the Crown Prince of Siam and his brothers, and I am quite sure that they will find that the paper is most interesting. It will be illustrated by a number of slides. I now call upon Mr. Warington Smyth to read his paper.

After the reading of the paper, the following discussion took place:—

Sir FREDERICK VERNEY: It has been my good fortune to be connected with the Siamese for nearly fifteen years, and I can say for Mr. Warington Smyth what he cannot say for himself—that of all the Englishmen who have ever gone out there, I do not believe that any man has more faithfully served that Government than Mr. Smyth; and I think we all agree with this, that when an Englishman goes out and serves a foreign Government well, he deserves well of his own country as well as the country he serves. Mr. Smyth has not only undertaken these journeys of which he has given us so faithful, intelligent, and pleasant an account; he has also undertaken for the country of Siam an extremely important work, for which these journeys were performed, and I am sure we all of us are glad to welcome him back to England. In his paper he has omitted the perils and dangers of the journey, and made the most of the pleasant and agreeable.

He possesses some of those qualities which are excellent for the Englishman who travels abroad. He has wide sympathies, undaunted energy, and he combines with that a tact and a sympathy which are very rarely found. I am extremely glad he has come before us to-night—and I for one, and I hope many more, wish him a full return of his health and strength, that he may do good work in the years to come in Siam and perhaps in other countries.

I believe that Mr. Arthur Balfour the other day in a speech stated that English interests in China were not territorial, but only commercial, or at any rate in the account I read he made that distinction between territorial and commercial interests. That is a distinction which Englishmen will never make in regard to Siam. We have seen that England's interest in Siam is territorial, and I hope it may long remain so. I hope, and I believe other people hold who know anything about Siam, that the integrity and independence of that country are certainly for the interests of ours. We have seen England and France meeting and shaking hands in an amicable way over the guarantee over the central and most vital portion of that country, and we hope that friendly feeling may be shown still further, and that Siam may long remain in the forefront of powerful if small progressive countries. The Siamese have a good right to be proud of the King of Siam, who has made himself known to Englishmen as well as many people in Europe by his intelligence and his progressive spirit, and his keen observation of manners and things during his recent voyages. Of one thing we have a proof to-night—of his confidence in Englishmen and England, and his sympathy with our country, for what greater confidence can a man show than to send his eldest son to be educated and trained in England, and many of his family?

Mr. ANNAN BRYCE: I am sorry that my experience of Siam does not extend to the regions which Mr. Smyth has told us of in his paper. The region of Siam I know is to the north of Bangkok, which has very few characteristics in common with the region which Mr. Warington Smyth has told us of to-night. There are one or two points I should have been glad if Mr. Smyth could have found time to describe, viz. the ethnological relations of these regions to the main body of the peninsula, but it would no doubt have taken him rather long and into regions rather technical, but if he could in reply tell us something about the ethnological relations of these regions, it would be of interest for a number of us.

Mr. WARINGTON SMYTH: In reply to the question Mr. Bryce has put to us, I would say the people among whom we travelled consist of regular Siamese, of Malays of a type which is, you may say, almost Siamese, and of the aborigines of whom I have said a few words. Of the latter there are two tribes in the southern part of the peninsula; as these have been carefully described in a paper, I think, by Mr. Daly some years ago, and elsewhere, I need not say anything further of

them. The Malays north of lat. 7° appear to have lost most of the characteristics of their race; to a large extent they have adopted the Siamese and have lost their own language, but they have preserved a certain number of their traditions and customs. They will not eat pork, and they prefer the sea to anything else, and so forth. One sees their relationship to their neighbours at Kelantan, but in most respects they are very unlike the *pukka* Malay; they have not the pluck and hardly the energy of the true Malay. Those who live among the Malays say they are the idlest of men; those who best know the Burmans say that the Burmans are the idlest of men. However that may be, the Malay of Singora must run them very close. The Siamese there, and at Lakawn, are true Siamese, very little mixed with the Chinese, as one often finds in the north. They preserve many old customs and traditions, now being lost near Bangkok. Their language differs slightly; the local peculiarity and the twang are difficult to understand, and puzzle all people from the capital. The Mons, Karens, and other races which we know in the north and down as far as Pechaburi are altogether absent, to the best of my knowledge, south of that; the Mons, or Talains, have been discussed before by Mr. Holt Hallett and Mr. Annan Bryce, and I need not say anything further of them, as they do not come within the scope of this paper. I believe that the Malay never really extended further north than the Kra isthmus, as above that they are not met with. North of Langsuan there are only Siamese, and a few Burmans who come across the frontier to do a little trading.

The PRESIDENT: I am sure a vote of thanks will be passed to Mr. Warington Smyth by acclamation. He has many rare gifts as a traveller. In this particular expedition he proved himself to be a most intrepid and daring sailor. It is no joke, in such weather as he encountered, to be in a little seven-ton boat with two or three landsmen, for they were no better. I forget whether he told you that he was on his beam-ends and battened down for several hours, and that he was at the helm for upwards of thirty hours at a stretch. Without that intrepidity and skill we should not have had the paper we have heard this evening, for he would have been unable in any other conveyance to visit these provinces. He has described them admirably, for, as Mr. Verney has pointed out, and we all feel, Mr. Warington Smyth has almost magnetic sympathy for all things that live—man, beast, or bird; he also has rare powers of description. Geographically, I think the most important part of his paper was his description of the way in which parts of the coast are gradually being filled up, not only by means of sediment which is worked down from the cliffs and mountains of the interior range, but also by the action of the north-east monsoon, which prevents any of that sediment from escaping away to sea, and thus forms islands and shoals, which, of course, eventually will be entirely reclaimed land. This takes place from many different causes in other parts of the world. I am reminded of the site of that naval battle under King Edward III. at Sluys, which is now a large tract of pasture land covered with cows, with a few villages dotted about what was once the sea and the large important commercial port of Sluys. In historical times Mr. Smyth tells us that what was once a large emporium of commerce is now a small agricultural village, and there can be no doubt that no more useful work can be done than to collect information as to the previous condition of such a country, and the causes which have led to this silting and drying up of large tracts formerly parts of the sea. This is only one out of many points of great interest which Mr. Warington Smyth has brought before us. We have to thank him also for the admirable sketches which he has made and which have illustrated his paper, and in the next room you will find a great number of most interesting photographs, sketches, and curiosities he has kindly brought

to show us. It now only remains for me to move a vote of thanks, and to convey to Mr. Warington Smyth that vote which has been passed by acclamation.

Mr. H. W. Smyth's Map of the Malay Peninsula.—The coast line is taken from the Admiralty Charts; the interior partly from the same source, and partly from the Siamese Government Surveys. Some details in the Bandon bight and the Inland sea are from prismatic compass surveys by Mr. Smyth. The boundaries of the states are in several cases from native sources.

STUDIES AMONG THE DRIFT-ICE OF THE POLAR SEAS

(with Reference to the Construction of Floating Breakwaters).

To the President of the Royal Geographical Society.

Sir,—

In my numerous arctic voyages I have been enabled to gain considerable experience with regard to the influence of floating bodies on the breaking and swell of the waves. Year after year I have had opportunities of making observations on a large scale in this direction, and I have endeavoured to study the phenomena thoroughly, in order to unravel the true reasons for the astonishing effects which many others before me, as well as myself, have observed.

I began my arctic work in the year 1858. I then accompanied Prof. Otto Forell to Spitsbergen. We had at our disposal a small fishing-smack of, I think, some thirty or forty tons. In her we started from Hammerfest, and sailed to Spitsbergen. There was a fairly heavy swell outside the Norwegian islands, but when we approached Bear island the swell suddenly went down, evidently in consequence of pieces of drift ice scattered over the surface of the sea.

We lowered a boat and started seal-shooting, as many of these animals love to bask on the ice. But it is well known that the landing on a rock or the boarding of a vessel in the open sea can seldom be accomplished without considerable difficulty. I myself have had some experience in the matter. Once, when I thought that the sea was perfectly calm, I tried to land on a skerry south of Iceland, formerly known as a rookery for great auks (*Alca impennis*). But though there was no perceptible swell on board the vessel, yet on coming to the skerry the breakers were so tremendous that we had great difficulty in escaping being swamped. Our voyage to Spitsbergen in 1858, in the small smack, which was a bad sailer, was troublesome in the open sea, so when possible we sailed close to, or rather within, the ice-belt, and it was then that I was able to see and to examine critically the astonishing phenomena in question. The same observations were made by me during the expedition of 1861, on the schooner *Æolus*. We anchored in lat. 80°, and organized excursions by boat to the Seven islands.

During these trips I had many opportunities of noticing the enormous difference it made whether we were in open water, or whether we were protected by a narrow belt of small fragments of ice. I noticed this phenomenon on a somewhat larger scale during the expedition of 1864, when the circumstances were greatly in favour of observations of this kind. I went to Spitsbergen then on a schooner-rigged gunboat of twenty-five tons burthen, a very small craft indeed. The object of the expedition was to complete the survey of the measurement of a degree of latitude which was to pass over Spitsbergen from north to south, a work which was begun as early as 1861. For this work it was necessary to touch at as many places as possible on the coast—there was no archipelago off these shores, so that when the sea was quite open, it was very difficult to land; but when we met with a place where the seaboard was hemmed in by scattered fragments of ice, there was no difficulty at all in landing, and the small vessel sailed on in a sea that was almost perfectly calm whenever it could get within a belt of ice. In 1868 I made observations again on this subject, but they were of another kind. I then wished to proceed northwards from north-west Spitsbergen, from about the spot where Andrée's balloon-house is. Our vessel was stationed there. I wanted to go further north in September or October, because the polar-basin ice was supposed to be less closely packed at that time than during the summer. Several attempts were made to penetrate further north from this anchorage, even after it was evident that at that time of the year there was but little prospect of getting very far.

We had plenty of coal, and our vessel was a small steamer well known in Sweden, but at present belonging to Finland, and still sound and seaworthy. This little boat, the *Sophia*, has gone through many vicissitudes. As a soldier feels pride in the wounds he has received in defence of his country, so we can say of the *Sophia* that she can pride herself on the many adventures she has undertaken, and in which she has always escaped foundering, thanks mainly to the excellent material of her hull, which is made of first-rate Swedish iron. We steamed northwards several times from lat. 80°, or, more correctly, lat. 79° 40′.

During the first 30 or 40 miles the water was free from ice, and the swell often very heavy; but when once in the ice, or, at any rate, after passing the border of the drift-ice, the sea became less rough, until at last there was a complete calm. These excursions were long favoured by good fortune, but on October 4 we had the misfortune to collide—north of the 81st degree—with an iceberg, which knocked a hole in the ship's side, and we had a very narrow escape indeed.

This calamity, however, was most interesting from a scientific point of view. The ship was just within the ice-belt, where heavy seas broke, and therefore made it very unpleasant; but had we gone only a few cable-lengths further on, we should have been in perfectly smooth water.

In 1870 I undertook a voyage to Greenland, and was then able to make similar observations, though under very different circumstances. I went to Greenland on a Danish merchantman, the *Whale*. The passage was a very slow one, so that my time for work was but short. On being landed at Godthaab, I spent that part of the summer which remained at my disposal mostly in a boat, sometimes a whale-boat, and sometimes an Eskimo skin-boat, called "umiak." These may have many excellent qualities, but are not particularly seaworthy. The coast is very open here, and the sea often very rough if the fairway is not sheltered, either by stranded icebergs or else by drift-ice. During my trips in these waters this often proved to be the case; so these excursions were most agreeable, and I could land where I wished. At last I made land excursions in the daytime, sleeping at night in the "umiak," when the Eskimo rowed me further along the shore—which could be done without the least difficulty, as the sea was quite calm, in consequence of the ice drifting along the coast.

Then came a new expedition in 1875, this time undertaken in a small Norwegian whaler, the *Proven*, which was of the measurement of about forty-three tons. We sailed first to Novaya Zemlya, then passed along the coast of this island, and finally sailed over the Kara sea to the Yenisei. Along the west coast of Novaya Zemlya there is no archipelago, only a skerry here and there, so that it was very difficult to land where the sea was open; but if an ice-belt lay outside, the sea was perfectly calm. The southern part of the Kara sea was pretty free from ice, as was also the middle part, consequently the seas were very heavy; so, as often as opportunity allowed, we went inside under the lee of the ice-belts we encountered, and invariably found smooth water. I experienced precisely the same conditions in my voyage of 1876. That the sea can be very rough in these waters, or, at any rate, for such small craft as I sailed in, I experienced in 1875, when I went up the Yenisei. A heavy sea set in up the river from the mouth, which was free from ice, and caused us much difficulty in landing by boat.

Then in 1878 came the *Vega* expedition. However, we then passed for the most part through tightly packed masses of ice, so I cannot say that I have any important observations bearing on this subject from this voyage—at least, as far as I can remember at present.

In 1883 I again went with the *Sophia* to Greenland, and again I had an opportunity of making observations in the same direction, and even of another kind than those I had previously made. I passed along the north-west coast of Greenland, and anchored in one of the deep fiords which have penetrated far into the land. While I made an excursion on the inland ice, the *Sophia* with part of the expedition was despatched still further north to Cape York. An English whaler was crushed to pieces by the ice on her way, but the *Sophia*

reached her destination and returned unharmed. Later on, the *Sophia* had hazardous adventures in the long fiords that intersect the west coast and the southern extremity of Greenland. I then proceeded in the direction of Iceland. As is well known, some northern colonies existed since the tenth century in Greenland, though discussions have arisen as to their exact position. I myself, at any rate, hold in this matter a different opinion from most other investigators of Greenland. At first it was considered that these colonies lay opposite Iceland. At the close of the sixteenth century, the Danish kings wished to regain their old lost colonies, and therefore despatched expeditions from Iceland to the east coast of Greenland, of which the first set off in 1579. It was unsuccessful, and so were the numerous expeditions, often equipped with the greatest care—numbering, if I remember rightly, eighteen in all—which during the three subsequent centuries were despatched to these waters, chiefly from Denmark. Of these I will only mention the very latest—the French expedition in the frigate *La Lilloise* under the command of Blosseville, which was lost with all hands; Sir Leopold McClintock's in the *Bulldog*, and Sir Allen Young's in the *Fox*, both returning with damaged vessels without being able to reach the coast of Greenland opposite Iceland. Their failure was caused by the difficulty of breaking through the mighty barrier of drift-ice and icebergs which surrounds this part of the coast of Greenland. There is a constant swell at the edge of the ice-belt; huge icebergs roll up against mighty stretches of bank-ice, and thus form an ice-mill that no vessel had been able to penetrate for three hundred years. A few years before my voyage in the *Sophia*, a celebrated Danish arctic navigator had declared in print that the passage was utterly impossible, and both Sir Leopold McClintock and Sir Allen Young sent me warnings when they heard that I intended trying my luck at this spot. Relying, however, on smooth water being reached immediately within the outer fringe of the ice-barrier, and that all danger would soon be passed if only the vessel steamed boldly ahead, I hazarded the experiment with my small craft, and succeeded. Where the conditions were favourable, I steamed right ahead. When in among the rolling icebergs and ice-fields, it seemed at moments that all was lost and destruction certain; but immediately after, when the outer belt was duly passed, everything was calm and still, and all danger was over. Over the pretty considerable expanse that intervened before land was reached, we sailed on through ice-fields which were driven along the coast in a southerly direction. Now and again a huge iceberg, owing to the influence of under-currents, went its own peculiar way, driving away the enormous ice-fields like froth, and leaving broad lanes in which there was no trace of swell, and in which the *Sophia* could calmly steam along to a very pretty haven which lay on the east coast of Greenland opposite Iceland, and which I christened King Oscar's

haven. After a short stay there I again steamed away, and had the same agreeable and calm sea until we sailed into the outer fringe of the ice-belt. There a very violent and dangerous rolling occurred among the icebergs and floes, when the deck-house was damaged by being nipped between two tossing ice-floes. The vessel, however, suffered no further injury.

Thus, during my farewell visit to the arctic seas, I was enabled to observe on the very largest scale the lulling effect of floating masses of ice on a heavy sea.

Once more I must lay stress on the fact in question having been observed a long time ago, as also on its having been the direct cause of attempts being made to use floating breakwaters for the protection of harbours. The literature concerning projects in this direction is very difficult of access. A Bluebook issued by the English Government is the best I know of. The House of Lords appointed in August, 1860, a committee to investigate "how far it may be practicable to afford better shelter for shipping upon our coasts than is at present afforded, by the adoption of some plan for the construction of breakwaters and harbours less costly and better adapted for certain localities than the system of solid masonry hitherto in use." The committee consisted of a duke, four earls, and eight other members of the House. Some of them were certainly sailors, and, at all events, the committee performed its duty in a most praiseworthy manner. Various persons who had experience in the matter were called before the committee and questioned. Their separate testimony is entered fully on the minutes, so that a precise idea is obtained as to the opinion and vote of each person on the matter. Among those examined were the most celebrated seamen and harbour constructors, as well as others, who evidently were no great specialists, but, on that account, perhaps, richer in imagination. From the report of this committee, it seems that in some places—more especially at one spot in France—experiments have really been made with floating breakwaters, but have led to no satisfactory results. This is, in my opinion, owing to the fact that they have disregarded the manner in which the sea acts, and have made attempts to protect the harbours by a few gigantic breakwaters. These have been anchored in suitable spots outside the harbour with the intention of thus affording the desired shelter. However, the difficulty has been that no chains ever yet made have held. When these huge masses have been anchored for a time, the chains break at last through the constant tension to which they are subjected. Attempts have been made to replace one strong chain by several smaller ones, but this also has proved a failure, as the chains snapped one after another, and, owing to this, these floating breakwaters presented a real danger, but no practical shelter to the harbour.

Let me further call to mind that similar breakwaters on a smaller

scale have also been utilized in the northern countries. As a specialist has observed, we in Sweden have employed weather-rafts, which have been placed with the view of sheltering a boat or an anchorage. However, here again there were difficulties to be encountered in anchoring the probably enormous rafts. This is a great disadvantage, and, from what I have been told, they do not seem to give any really satisfactory shelter. Any one, however, who has had the opportunity of closely observing how the floating pieces of ice, in spite of their insignificant size, affect the sea, must feel that this effect is not caused by the momentum of the fragments of ice, nor yet by their size, but that their effect consists in disturbing the waves and causing a change in them, both as regards their length, height, and direction. Now, when several such waves, which differ in their nature and direction, meet, their momenta destroy each other, and there arises what is called in physics "interference." The fundamental reason why these loose fragments of ice so completely calm the movements of the waves must accordingly not be sought in the fact that the power of the wave is absorbed, but in the circumstance that the waves are irregularly deviated in different directions, and then interference arises. Should this take place under very favourable circumstances, two waves, even though of enormous size, can neutralize each other. The same thing is observed in optics, where, under certain conditions, two waves of light do not increase, but diminish or destroy each other. If these observations are correct, it is evident that fresh attempts should be made to give shelter to a harbour by laying out, not a few large, but a number of small, floating breakwaters. Probably a large number would be needed, but a harbour is an expensive piece of work, and is well worth a considerable outlay. When a certain harbour was in course of construction here in Sweden, I made a proposal that an experiment should be allowed in this direction. I came too late that time, but I shall try to raise the question again, so that experiments may be made on a small scale at one of our harbours, in order to ascertain whether, by surrounding the harbours with a large number of small floating breakwaters, a satisfactory shelter can be obtained for vessels or for the moles of the harbour. On our coasts, where our skerries are a natural protection against sea and storm, a harbour of refuge such as I have proposed is needed in but few places. Few countries, however, are in this respect so fortunate as Sweden and Norway. The coasts of other countries are generally open to the sea, so that a shelter for vessels on the above-mentioned principles might prove of inestimable value.

A. E. Nordenskiöld.

A JOURNEY THROUGH THE KHINGAN MOUNTAINS.*

By Dr. A. DONALDSON SMITH.

WHEN we started north from Peking on May 19, 1897, *en route* to Mongolia and Siberia, it was our intention to travel through that part of the Khingan range which lies between Dolon Nor and the upper branches of the Nonni river, and to eventually reach the Amur. We were successful in this, and although we were disappointed in not getting much shooting, we managed to collect over a hundred different varieties of moths and butterflies, besides many birds and other natural history specimens. For the reason that the journey was undertaken for pleasure, I did not attempt to make a minute survey of the country, so that the map which I have presented to the Society, and which is based on rough compass work, is subject to errors in regard to the exact positions of the places I have marked on it. The Europeans of the party consisted of Mr. J. E. Farnum, Mr. G. L. Farnum, and myself.

At first our journey led us through the flat basin lands which have been formed to a great extent by the alluvia brought down by the tributaries of the Pai Ho, and which are under a high state of cultivation. Villages, consisting of about thirty houses each, occurred at intervals of two miles, besides the occasional larger towns of a thousand or more inhabitants. In and about the villages grew clusters of tall elms, pine trees, and willows, but with these exceptions scarcely a tree was visible. A strong wind blew constantly from the north-west, laden with the finest dust that the Mongolian plains can boast of, and this, together with a scorching sun, had a tendency to reduce the length of our marches at first. As Dolon Nor, or Lama Miao, is a large trading centre between China and Mongolia, inns are to be found 12 miles apart, where eggs and plenty of fresh vegetables can be procured for strings of cash or copper coin. On our second march we crossed a small stream called Sha Ho, and later a tributary of the Pai Ho near the large market town Nu Lan Chan. The Pai Ho is only about 50 yards wide here, but it is subject to enormous floods, as are all the tributaries of the great river at Tien-tsin. The following day the mules had hard work dragging the carts along a sandy path by the side of the Pai Ho, but later the road swung away from the stream, and we found ourselves approaching the base of the great mountain system which forms an escarpment to the almost boundless plains of Mongolia.

We passed two quaint old towns called Mi Yuen Chan and Shi-Hia, both of them surrounded by well-preserved walls, relics of the Ming dynasty, but now almost deserted and very dilapidated in the main part. Entering a broad valley, we were now delighted at the change of scenery from the monotonous, cultivated, and dusty plains. The

* Map, p. 580.

valley was surrounded on three sides by mountains 2000 feet high, presenting very fine rugged lines, and green to their summit. There were a few clumps of trees about the defiles, but the mountains were in other respects more free from wood than the hills of Scotland, covered with a low shrub only a foot high, and luxuriant grass that affords nourishment to vast flocks of sheep and goats. A rough stony road at the end of the valley led up almost to the top of the mountains, and through a very

TA LAI HU SHU.

ornate and massive gateway called "Nan Tien Men," or "South Gate of Heaven." Descending one or two turns of the road, we now entered the town Ko Pi Kau, where we found ourselves surrounded on all sides by the Great Wall with its numerous ramifications, which extended like the arms of a giant octopus over mountain and valleys as far as the eye could follow them. Leaving the Great Wall on May 24, we wound in and out of the mountains and along a broad river-bed, to the busy town of Lu Hai Kau. From here those that were mounted set out ahead of the carts, riding first over one pass 2000 feet high, and then over

another of about the same height, each pass surmounted by a quaint Josh temple.

The next day's march (27 miles) afforded us beautiful mountain scenery. We crossed one pass, 2411 feet high, that reminded me much of the Stelvio, on account of the numerous windings of the road which could be traced from the summit deep down to the bottom of a narrow and rugged valley. From here on, till we reached Siberia, we heard much of robbers, and occasionally caught sight of a few; but we did not fear them, as they are not eager to rob Europeans, and especially a party as well armed as we were. The brigands, however, are a source of constant dread to the inhabitants and to caravans, since they are well armed with Mauser rifles, and have strong swift ponies. Passing down through the narrow gorges, we came to the river Hang, which wound its way through a broad fertile valley, in which lay the town of Lu Chia Yang, where we found a good inn to stop at for the night.

On May 27 we climbed gradually through beautiful valleys, following the windings of the Hang Ho, or "Dry river," and had the pleasure of meeting Dr. Eugen von Cholnoky, professor of geography in the University of Budapest, who had made a journey to Khalgan and Dolon Nor, and who was now on his way back to Peking. He reported very cold weather at Dolon Nor. We were now enjoying very comfortable weather, the mercury usually falling as low as 45° Fahr. at night, and rarely rising above 75° in the daytime. The second march after this we came to a small village 6 miles beyond Ku Chia Tuen, where a path diverges a little towards the left, and afterwards meets the main road 10 miles further on. Hearing that this path lead to a lama temple, Mr. J. E. Farnum and I left the caravan and followed it. We reached the temple, which is called San Ti Ying, and discovered that the buildings were not very large, although picturesque. Leaving the temple, we rode a little west of north over a very steep pass, till we joined the main road again and caught up with the caravan, which was having difficulty in negotiating a bad bit of marshy ground. Although a long time on the road, we only covered a distance of 14 miles on this march, stopping at Pan Pi Shan for the night; but we made up for this the next day by travelling all the way to the large town of Ku Men Tzu, which is situated 40 miles beyond Pan Pi Shan, and 30 miles south-east of Dolon Nor (distances are given in English miles by road). On the last day of May we climbed to the high plateau of Mongolia, trotted rapidly for a few miles over a plain as flat as a billiard-table, and then entered the large town of Dolon Nor, where we were destined to spend ten days. Leaving Dolon Nor on June 10, we made three short marches to a little village called San Lao Ho Tzu (37 miles), in the outer imperial hunting-park. The valleys were broad, and intersected only by low ranges of hills about 1000 feet high, and not a tree or bush even was visible. The inhabitants numbered scarcely forty to every 10 square

miles, and these were poor and thriftless, consisting of petty farmers or sheep, cattle, and pig drivers. The only fuel we could get was the dried refuse of cattle or camel stalls, which gave our cook much trouble, until he caught the trick from the Mongols of digging a slanting trough in the ground, in which a fire can be made with *bois de vache* hot enough to melt silver. On June 13 we started off at a very slow pace. A day of hard rain had made the road muddy, and the cart was a source of much annoyance. All our servants, excepting No. 1 boy, were slow

THE FLOODED NONNI.

lazy, and discontented. It took them two hours to load the camels every morning, a job that my Somali boys used to accomplish in Africa in twenty minutes. After a 6-mile march we came to an encampment of Chinese, who were tending some thousand or more camels for the summer. Their camp presented a busy scene, for they were covering the camels with tar-oil from head to foot, at the rate of one in every five minutes, and pulling away the few remaining masses of last year's wool that still clung to some of the beasts. Camels are worked in this part

of the world nine months of the year, and they are then allowed to rest for three months, after having been given a coat of tar to heal their sores. They are at their worst in June, when their holiday season begins; and, although ours were in exceptionally good condition, they showed nevertheless the result of a long winter's work, when they had to labour many hours daily with 400 or 500 lbs. on their backs. Yang Shon Pai is a little police-station, situated on a high plateau near the top of the Khingan range. The main range runs directly south-west from the Amur river, until it merges within the eastern extension of the Nan Shan chain north of Peking; but it throws out many flying buttresses, as it were—mountain chains that run far away to the east, so that a man travelling through these offshoots might mistake them for the main watershed. The plateau lands are situated at an elevation of approximately 5000 feet, while the peaks rise to 6500 feet, and occasionally to 7000 feet; but the mountains do not seem very high to one approaching them from the west, as they form the eastern bulwark of the great Mongolian plateau, which is in itself more than 4000 feet above the sea-level. On our next march we crossed an almost flat bit of country at an elevation of 5000 feet, passing several little springs and rivulets flowing south-east into branches of the Pei Ho, and then after 15 miles the road led us through a narrow valley between high mountain peaks to a small settlement of Mongols and Chinese, called Hai Mu Ku. The valleys were here covered with trees, as well as the northern slopes of the mountains, and in consequence of this there was considerable game about, in the shape of the small barking deer, called "pause" by the natives; the larger spotted deer; the Manchurian wapiti, or "lou;" and wolves and wild cats. The forests were composed of spruce, birch, larches, and a few maple trees.

On June 25 we made a short march of 9 miles to the middle of a broad grassy undulating plateau, 6102 feet high, where there was a small pond of rain-water. The next march took us over a pass on the eastern side of the range, to the village of Chang Ku Tai, where there is a stream 50 yards wide, and a good road running eastward along it. After this there was a low stony pass to cross to a narrow valley, in which was situated the little village of Tsao Hu Ku. The mountain peaks on either side of the valley were very jagged and bare, and differed much from the broad rounded mountain-tops we had seen ever since we left Dolon Nor, although they were geologically the same, being of ancient volcanic origin. At the end of the valley there arose a little stream that gradually widened as it flowed north into the Shi La Mu river, and about this brook hovered myriads of beautiful butterflies and moths. They were remarkable, not only on account of their numbers, but also by reason of the great variety of species they represented. Until we arrived on the eastern slope of the mountain range we saw few butterflies, but now we were kept very busy with our hand-nets till we

reached the end of our journey. It was different with the birds, for, although we shot about forty different varieties between Peking and Dolon Nor, we were only able to increase our collection by a dozen more species before reaching the Amur. Of flowering plants there was an infinite variety throughout the entire length of our journey, but these were especially beautiful on the high plateaus, where they made a display such as I have never before witnessed. Warm weather was in

THE RIVER TSHOR AT PU LA SU KU. LAMASERY IN THE DISTANCE.

store for us as we gradually descended to lower levels. The mercury rarely fell below 63° at night, while the maximum for the daytime was 90°, and during the whole month of June we only experienced three days of hard rain, besides half a dozen light showers.

A couple of marches now brought us to the confluence of the Shi La Mu river and the Pao Li Ku Ho, two streams each about 30 yards broad and 3 feet deep in the dry season, but which often rise in the spring and autumn with wonderful rapidity, overflow their broad

sandy beds, and cause death and destruction throughout the country a long way inland.

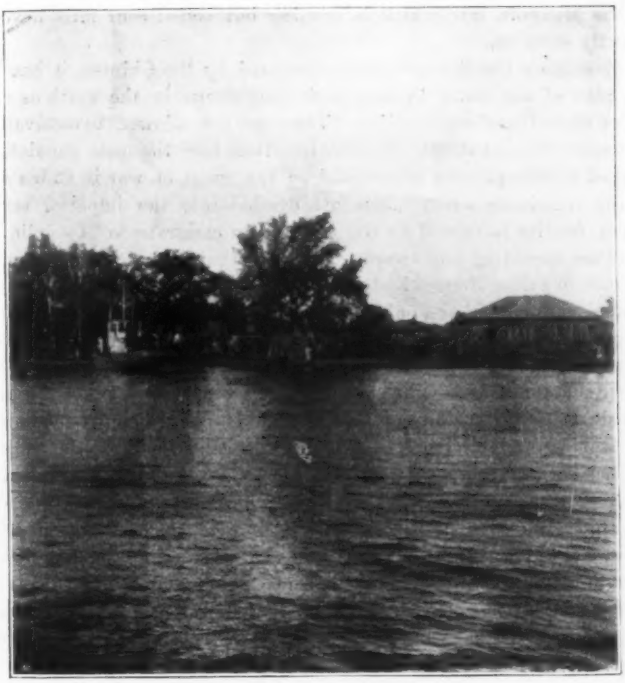
After following the Pao Li Ku Ho for 10 miles, we came to the large town called Ching Pong, which is situated at the foot of a low range of hills where two valleys meet. The inhabitants numbered about 5000, and are mostly Chinese. There is a lamasery, containing one hundred priests, on the outskirts of the town, but with this exception one sees very few Mongols. Vegetables, such as beans, onions, pumpkins, peas, spinach, radishes, and carrots, are raised near the town, and many acres are planted in maize, sorghum, millet, wheat, and oats. Most of the things in daily use among the Chinese, as well as among the Mongols, are manufactured here, and there is also a considerable trade with Dolon Nor and Jehol. There were many apricots in the markets, imported from the latter place, and a fish resembling perch, salted and brought from the fresh-water lake Talka, which lies to the west beyond the mountains.

We rested three days at Ching Pong, and then made two marches north-north-east, passing many villages with a mixed population of Chinese and Mongols, to the small town called Long Shan, where there was a hot sulphur spring. On this march we followed the river Pao Li Ku to its sources, 14 miles from Ching Pong, and then, crossing a low pass, came to a little stream flowing north. The supreme prince of eleven provinces of Mongolia, Mau Nau Hang Wang, was camped at Long Shan with his nephew and a guard of fifty soldiers. It was his custom to spend twenty-one days of each year of the spring to take the sulphur baths, camping close to a number of lama temples, in which there were tubs reserved for nobles. Immediately upon our arrival the prince sent word that he would like us to stop the next day and visit him, accompanying the message with a present of a sheep. Accordingly, the following morning we rode over to the Mongol camp, and were received by the prince and his nephew in a most courteous and hospitable manner. The royal tent was rectangular in shape, and had a top that resembled much the roof of an ordinary Chinese house—flat in the centre, and curving gracefully towards the sides and corners. It struck me that the Chinese may have got the design for the pretty lines of their roofs from tents like the one I have described.

Prince Nau Hang Wang is a slender man, forty years of age, with very bright, intelligent eyes and aquiline features. He is descended from a long line of noble ancestors, and on this account, as well as on account of his being suzerain to eleven other princes of Mongolia, he is held in high esteem at the court of Peking. He seemed very desirous of having a large army under his command, and he has lately sent two agents to Europe to purchase the most improved modern rifles. He asked me if I could not suggest some means of increasing the efficiency of his troops in keeping down the robbers, to which I replied, that the

first step to be taken in that direction would be to pay the soldiers sufficiently that their existence should not depend upon bribery. No more questions were asked after this regarding the constituted forms of Chinese government, but several hours were spent in pleasant conversation on general subjects, the prince paying us a long visit in our tents in the afternoon, and bringing presents of oily sweetmeats.

Leaving Long Shan, we made three marches in an eastwardly direction to the village of Sa Pa La Lai, crossing several valleys and fording



AT THE JUNCTION OF THE AMUR AND SUNGARI RIVERS.

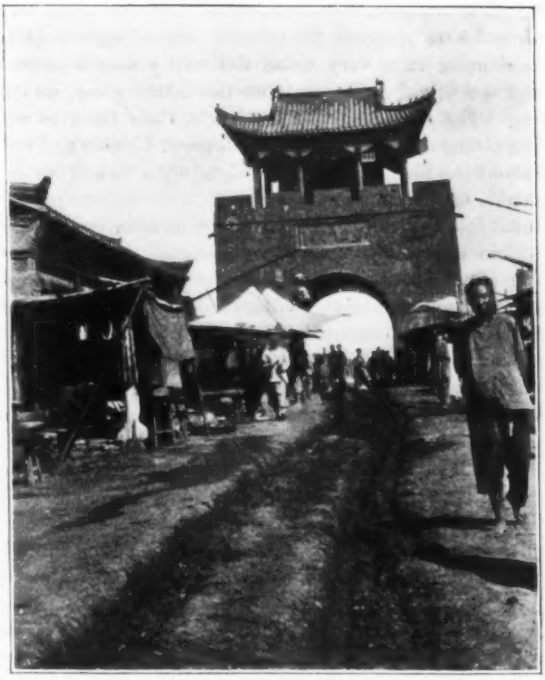
three small streams. We were now in the province of Parin, and near our camp was a military parade ground and a tower, from the top of which the prince of Parin was supposed to review his troops. We stopped at Sa Pa La Lai more than a day, and made a little side trip to a group of mountains, 6000 feet high, which lay immediately to the south of us.

Our next two marches were through an uninhabited country as far as the little Mongol village called Hu Pu. Here there were no Chinese

whatever, and the round latticed tent of the Mongol took the place of mud houses. We were destined to meet no more Chinese now for several marches, and we were glad of the change, for the Mongol is a much more agreeable person to deal with than his almond-eyed neighbour. We were treated with much hospitality whenever we visited a Mongol's camp, being offered anything there was in the tents to eat or to drink. The native food is repulsive to European palates, consisting of very sour cheese, spirit made from milk, hot bread, and cakes composed of millet or poor wheat flour, sour milk, and a concoction which is called "tea" by the Mongols, but which is nothing but boiled sour milk flavoured slightly with tea.

Ever since the Mongols were conquered by the Chinese, it has been the plan of the latter to keep their neighbours in the north as much under their thumbs as possible. These are not allowed to cultivate the rich soil of their valleys. A little less than half the male population is obliged to take priestly orders, and in the event of war in China many of the remaining adult males are drafted into the imperial service. Every facility is offered to the Chinese to emigrate to Mongolia, and these are spreading northwards so rapidly, that in a few years it will be difficult to find a Mongol in Eastern Mongolia. The rich and luxurious princes and barons are only too willing to bow down to the Chinese authority, that they may continue their easy existence. The land is the property of the nobles, and on this the poor Mongol is allowed to exist under sufferance, as it were. The Mongols whom we saw could scarcely be called nomads. Many of them do not move their tents at all, while the others merely change their quarters from one side of the valley to another according to the season; perhaps camping on the side of a hill to avoid the swarms of flies in July and August, and in winter-time choosing some spot which is sheltered from the north-west winds. Every tent is guarded by three or four savage dogs, which make it very unpleasant for the passer-by, and, indeed, dangerous to any one approaching them unarmed. The villagers are rich in ponies and cattle, and also raise a few sheep and goats. After leaving Hu Pu, we travelled 16 miles to a village situated at the edge of a "hunting-park," which marks the boundary between Parin and Wu Chu Men Ching provinces. Just below the village two streams unite, the larger of which is the Cha Hau Mu Lun, and at their junction a tall white tower rises about 50 feet in the air, built of stone and plastered; but all the natives could tell me about this was, that it had been built several generations ago to the memory of a deceased lama. From here a road leads across the mountain range to the desert on the western side, and then turns north. This is used by the salt caravans coming from the north-west, and from the reports furnished me, that the mountains can be crossed in one day's march at this point, I believed there was a considerable gap in the latter. Here also the

most northern branch of the Great Wall, composed principally of mud, with a few stones indiscriminately mixed, and only 10 feet high, winds its way across the mountains. I was informed that this structure, which we crossed again a little further on, is connected with the wall dividing Korea and Manchuria, and that it is projected all the way to Tibet. Immediately to the north of Pai Lu Tzu, a tall chain of mountains, much broken in places, stretches far to the east, and the road which we now followed took us over a pass through these mountains



MAIN STREET IN TSITSIHAR.

at the height of 5400 feet. On reaching this elevation, we stopped for nearly two days in a valley by the side of mountains 7000 feet high. This part of the country was very thinly populated, camps consisting of half a dozen tents occurring at intervals of every 20 miles, and there were many robbers about. We saw some of these gentlemen occasionally, but they did not trouble us in the slightest degree. The only things to annoy us now were the flies and mosquitoes, which made their appearance in ever-increasing swarms, and which continued to be our constant

companions till we reached the Nonni river. In the so-called "hunting-park" we saw, for the second time on our journey, a number of well-wooded valleys, and we were told that there were argali in the mountains; but we failed to find any signs of either wild sheep or goats, our bag consisting of only one spotted deer. The mountain streams contained several varieties of small fish, which we collected for scientific purposes, but none of them afforded us any sport excepting the ubiquitous chub. It surprised me that we found no trout, either in the streams flowing into the Yellow sea or in those emptying into the Nonni.

On July 14 we marched 23 miles to the village of Lung Ku La, which is situated in a very broad flat valley near a large lamasery. There was a festival in progress at the latter place, and it was an interesting sight to see the Mongol girls, their features and figures resembling German peasants, but clad in green blouses and red trousers, dashing about the plain like circus riders, often two or three together sitting astride of the same pony.

The next four marches took us through a country much cut up by low mountain chains and grassy round-topped hills, our course now changing more and more towards the east. The valleys were usually broad and flat, and contained villages of comparatively large size; that is to say, they consisted of groups of fifteen tents. Leaving a village which rejoices in the name of Ta Lai Hu Shu on July 19, we made three marches, one of them at night through an altogether uninhabited valley to the large settlement of Ho Yen Ko La. A journey of a couple of days more brought us to a village in the hunting part of Cha Se Tu province, where there were a few mountains sparsely covered with trees and apricot bushes. The natives grind the stones of the apricots, which grow wild in many parts of this country, into powder and use this as food. Just before reaching the village, and again soon after leaving it, we crossed the Great Wall, which here forms a loop.

On April 6 we arrived at a village on the Guileli river, where, besides a few Mongol tents, there were houses built of clay, and where we met the first Chinese we had seen for eighteen days. Each house was surrounded by a garden, in which grew cucumbers, beans, and maize, but there were no cattle or ponies. Many of the inhabitants earn a living by cutting down the small trees which are plentiful on the mountains, and selling the poles and carts which they make from them, while the remainder hunt wild pigs and deer. The mountains here began to disappear, and the valleys broadened out into great plains. Another march brought us to the village of Tu Ye, on the Tu Ye Ho, or river "Torre," as it is called near its junction with the Nonni. The river divides into three parts at Tu Ye, each outer branch being 35 yards wide, and from 2 to 4 feet deep. We managed to ford these

streams without the use of a boat, but in times of flood everything must be taken across in "dug-out" canoes.

On July 29 we had another larger river to cross, the Chau Ye Ho, called the "Chor" in the south. Where we encountered it, at the village of Hu Ku Li, it was split into four branches. After three more marches we reached another large river, the Ya Li, which we crossed by boat; and then there lay before us a great treeless plain, marshy in places, and intersected by a small river, the Ko Li Er. We passed several thriving Chinese villages on our journey across this basin of the Nonni river, and saw considerable land under cultivation. On August 5 we arrived at the banks of the Nonni, and camped near some villages lying opposite to the town of Tsitsihar. The latter place is called by the natives "Bu Kui," and the name "Tsitsihar" is given by them to a town, which I was informed lay 3 miles to the north of us, on the western bank of the river Nonni. The Nonni, which is usually only half a mile wide, was nearly 10 miles wide when we reached it. Although we experienced only five rainy days during the month of July, heavy rains must have fallen in the mountains to the north of Tsitsihar. We stopped four days before the ferry boats dared to take us across the flooded river; and then, when on August 9 we got all our animals and baggage aboard one of the large flat-bottomed boats, resembling a canal boat, we were obliged to spend eight hours in poling and rowing before we reached Tsitsihar. I will pass over the rest of our journey, since we had now reached a town where there are telegraph stations.

THE CENTRAL ANGONILAND DISTRICT OF THE BRITISH CENTRAL AFRICA PROTECTORATE.

By ROBERT CODRINGTON, Collector of Central Angoniland, B.C. Africa Protectorate.

The Central Angoniland District of the British Central Africa Protectorate * comprises an area of about 6500 square miles, and is bounded on the east by Lake Nyasa; on the south by the Portuguese territory north of the Zambezi; on the west by the country of the Angoni-Zulu people, owing allegiance to Mpeseni and falling under the influence of the British South Africa Company; on the north by a line forming an ethnographical boundary with the Marimbe district of the Protectorate. The boundaries to the south and west are determined by the watershed of Lake Nyasa, all of which falls within the Protectorate.

The part of the coast of Lake Nyasa which forms the eastern boundary of Central Angoniland is well provided with roadsteads, of which Domira bay is the safest and most convenient; very serviceable

* Long. 34° E., lat. 14° S.

anchorages are also found at Kajulu, Rifu, Leopard bay, Maganga's, and Kachinda-Moto's. Except at Rifu, where there are three isolated hills, the lake-shore presents a low sandy beach bordering a fertile and somewhat marshy plain, sloping gently for from 15 to 20 miles to the foothills of the Kirk range, where the land rises abruptly from 1600 feet to a plateau averaging 4000 feet above the level of the sea, studded with granite peaks rising to 6000 and 7000 feet. The higher part of the plateau, which lies to the south and south-west, is a rolling fertile plain, somewhat deforested by the requirements of a dense population; the lower part, which lies to the north, is almost entirely deforested, of a less fertile character, and much more uneven. To the west the plateau runs down to the sources of the Bua river, becoming less rugged and more fertile. Belts of valuable timber exist, especially in the foothills of the Kirk range. The country is drained by several rivers of considerable volume, several of which, converging at various points, subsequently, under the name of Lintipi, flow into Lake Nyasa. This river if only navigable for canoes for about 15 miles from its mouth when swollen with the rains.

There is no monotony in the landscape, which, indeed, presents many picturesque features. The austerity of the granite peaks of the plateau is pleasingly relieved by green-edged mountain rivulets, and native huts perched wherever foothold can be found. From the Kirk range is displayed a magnificent panorama of Lake Nyasa, and from the lake-shore the wall of mountains, often cloud-capped, rears itself on the one hand, whilst the broad expanse of the lake stretches to the islands and headlands on the other.

Big game is abundant in the less populous parts, and many elephants are killed every year towards the Bua river. The kudu, water-buck, and impala are commonly met with, and more rarely the buffalo, eland, and sable antelope. Lions and leopards are very numerous and cause considerable loss of life, as do the crocodiles and hippopotami in the rivers and lake.

Large herds of cattle, sheep, and goats are owned by the Angoni, and are noticeably free from disease, although the herds on the plateau undoubtedly thrive better than those of the lowlands. Horses have not yet been introduced, but it is probable that they would do well if carefully brought up through the Shire valley. I have noticed tsetse fly in only one narrow forest belt between Lake Nyasa and Chewere's country.

The principal agricultural produce of the country consists of maize, sorghum, casava, rice, millet, sweet potatoes, varieties of beans and peas, cotton, oil-seeds, and tobacco.

Alluvial gold has been reported to exist at the sources of the Bua river, and a gold-bearing quartz in the Lintipi valley. Lead and graphite have been found; iron is generally abundant.

Good roads have been constructed connecting the residences of the various Europeans with one another and with the port of entry on Lake Nyasa. Some of the native chiefs are making and repairing roads through their territories in order to facilitate communication with the Administration stations, to which they are accustomed to come for redress of grievances and to pay visits of ceremony. The value of roads for the convenience of both European and native travel, and for the quick movement of troops should occasion arise, can hardly be over-estimated. The African Transcontinental Telegraph Company's line is in course of erection, and will shortly serve for direct communication with the Government headquarters at Zomba.

ANGONI VILLAGE.

The Dutch Reformed Church of the Cape Colony have three mission stations in the district, with a staff of about ten Europeans. Their schools are everywhere well attended, but the instruction of natives in industrial work is not, unfortunately, a feature of their teaching.

As yet the cultivation of coffee successfully carried on in the Shire highlands has only reached the experimental stage in the country under review, but there is no reason to doubt that the foothills of the Kirk range are suitable for planting, whilst the advantage of cheap and abundant local labour will probably outweigh the disadvantage of more expensive carriage to the coast.

No systematic observations of climatic conditions have as yet been recorded, but I hope on my return to make arrangements for regular and accurate observations. On the plateau the months of June and

July are unpleasantly cold, and those of January and February unpleasantly damp. During the remainder of the year the climate may be truthfully described as delightful.

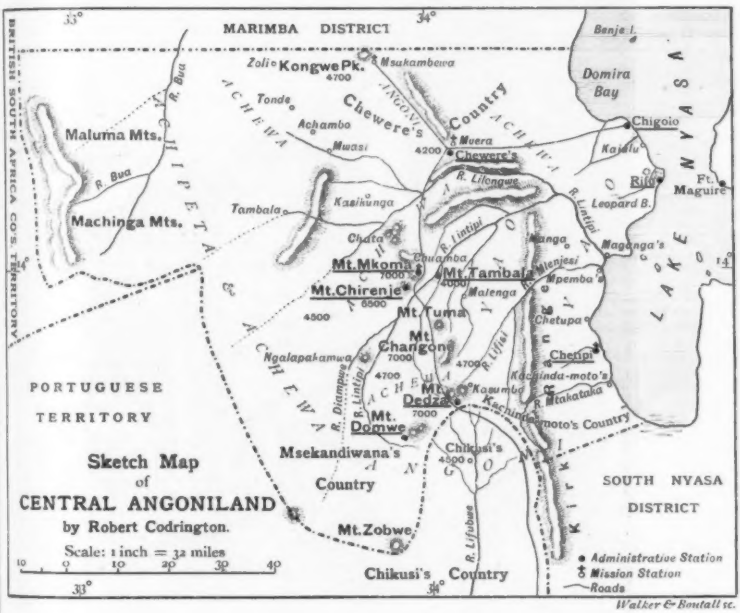
The few Europeans resident in the district, all of whom are engaged in missionary work and remain for the most part at their stations in the high country, have enjoyed as much immunity from African fever as can be expected in any part of the Protectorate. One death, however, from blackwater fever occurring after fourteen months' continuous residence on the plateau, seems to point out that exemption from this, the only desperately dangerous type of the disease, is not to be reckoned on even at an altitude of 5000 feet. It is not improbable that European settlers will be found, at a later date, willing to take up land for agricultural purposes on the healthier parts of the plateau, although the present difficulties and expenses of reaching the country, together with the absence of any available market for their produce, must, apart from the question of health, preclude any development in this direction for many years.

The native population of the district numbers approximately 250,000, of whom 20,000 are of the Yao race, and the remainder Angoni and Manyanja. The Angoni * are descendants of a Zulu tribe which migrated from Zululand and crossed the Zambezi about the year 1825, the majority of whom formed a Zulu kingdom south-east of Lake Tanganyika. Some of their number remained, as far as can be gathered, in the high country to the south of Mount Dedza, constituting a tribe ruled by a chief bearing the name of Chikusi. Some years later the Tanganyika country was abandoned, the several powerful chiefs composing the Angoni nation migrating to the high country west of Lake Nyasa, of which they forcibly possessed themselves and formed the separate kingdoms of Mombrera, Chewere, and Mpeseni. A tribe now inhabiting the country to the east of the Livingstone range, and known as Magwangwara, was also formed about this time. There are to-day three independent tribes of Angoni inhabiting the country of which I am writing, governed by chiefs bearing the names of Chewere, Msekandiwana, and Kachinda-Moto, the territories owing allegiance to each of whom I have depicted on the accompanying map.

To the first generation of Angoni born of the women of the conquered country, the language, dress, and customs of their Zulu progenitors have been handed down in a slightly modified form, although their language of everyday intercourse is purely that of their mothers. This class, which now forms the aristocracy of a nation which has embraced a great part of the original natives of the country, is being perpetuated almost entirely among themselves. Their dress is composed of a sporran of cat-tails, which is considered to meet the requirements

* Agoni, Abangoni.

of decency; whilst for purposes of warmth and display, a large sheet of cotton cloth, either of native or European manufacture, is thrown over the left shoulder, falling in folds around the body and leaving the right arm and shoulder exposed. When engaged in war and war-like ceremonials, kilts of cat-tails and skins are worn around the waist and sometimes over the left shoulder, together with a head-dress of raven's and cock's feathers. Their weapons are stabbing assegais, the shafts ornamented with the skin of a long-haired goat, and clubs or knob-kerries. A shield of antelope or cowhide, exactly similar to that of the



Zulu and Matabele, is also carried. Their system of warfare is a survival of the Zulu customs, but the reputation for courage which they have acquired is probably beyond their deserts, which may be accounted for by the fact of their hostilities having seldom met with any determined resistance on the part of the timid people whom they have subjugated. Personal ornaments are much affected: strips of hide with the long hair hanging down are fastened on the leg below the knee and round the upper arm; armlets of the horny substance of the elephant's foot are worn, as are ivory bracelets by persons of distinction. Charms, sometimes in shells, or cases covered with beadwork, sometimes contained in the horns of a small antelope, are worn suspended from the neck or

waist. Amongst the older people the Zulu head-ring of plaited hair and wax, in an exaggerated form, still survives, but is seldom seen in the younger generation. Holes are invariably bored through the lobes of the ears, and are often distended by blocks of polished wood or ivory. Ordinarily of an upright and independent carriage, they assume, on salutation of a superior, an obsequious demeanour, gently clapping their hands and calling out the word "Master," or, where such exists, the name

YAO WOMAN POUNDING MEALIES.

of the totem of the person addressed. Their chief wealth consists of herds of cattle appertaining to the chieftainship, and of flocks of sheep and goats, the property of individuals.

Their villages are large, and are composed entirely of circular wattle and daub houses, surrounded by compounds fenced in with reeds. The chiefs are possessed of arbitrary power, but in practice the advice of a numerous body of councillors is invariably sought in all matters of importance. These councillors, or indunas, are in turn responsible to the

chief for the conduct of affairs in the various districts in which they exercise authority.

Their religious ideas take the form of worshipping the spirits of immediate ancestors, who require to be propitiated from time to time. The chief is, by virtue of his office, high priest, whilst a class of recognized medicine-men and witch-doctors are also possessed of degrees of priestly authority. The burial-place of the chief is beneath the dung of his principal cattle kraal, which is afterwards reduced in size, but

ANGONI WARRIOR.

continues to shelter a few head of his more valuable cattle. The propitiation of his spirit takes place at a tree or rock at some secluded spot in the vicinity of his village, which is in some manner dedicated to or identified with him.

The history of the Yao * people in Central Africa has, until now, been the history of the slave-trade. From their country, lying between the East Coast of Africa and Lake Nyasa, and on and about the Lujenda and

* Wa-Yao, Yawa, Ajawa.

Ruvuma rivers, they invaded and conquered the greater part of the Shire highlands, and although they in their turn were much harassed by Angoni and Magwangwara raids, they have, for the last forty years, occupied the country lying to the south and south-east of Lake Nyasa as far as the Blantyre and Mlanje provinces. They also obtained possession of much of the east coast of Nyasa, especially points advantageous for the working of the slave-dhows, which were built under the instruction of the Arabs, and in course of time villages were established on the west coast of the lake, whence the more enterprising penetrated some 30 miles into the interior.

The Arab slave-trader found in the Yao a willing and capable agent. Of splendid physique and ready intelligence, the Nyasaland Yaos were continually engaged with the Swahili-Arab coastmen in this traffic, until the decisive and final overthrow of both Yao and Arab power by the forces of the Protectorate, under Sir Harry Johnston's Administration in 1896. The form of civilization presented by the Swahili-Arab slave-traders is much appreciated by the Yao, who has readily acquired Mohammedanism. Although little understood and very imperfectly practised, the leading principles of the teaching of Mohammed serve to develop in his followers the virtues of sobriety, cleanliness, and self-respect. The perpetuation of this faith, which is, however, distinctly antagonistic to British influence and control, is a matter which receives considerable attention from the chiefs and headmen of the tribe. Schools for the instruction of their youth in reading and writing Swahili in Arabic characters are established in nearly every village, where also prayers are made at regular intervals during the day. Fasts and feasts are also observed. Consequently, the Nyasaland Yao is not at all inclined at present to embrace the teaching of the Christian missionary. Mohammedanism, however, although at present increasing, must eventually exercise less influence over the people as they come in closer contact with Europeans and have less intercourse with the Arab, whose mission on Lake Nyasa may be said to have terminated.

The dress of the Yao consists entirely of cotton cloth tied round the waist and reaching almost to the ankles, with the exception of Mohammedans, who affect the costume of the Swahili. Their weapons are the muzzle-loading trade musket, and knives with ivory handles fashioned by themselves. Personal ornaments, with the exception of ivory or metal bracelets, are not much worn by the men, who, however, like to cover their heads and shoulders with gaily-coloured calico. The women make and wear a considerable quantity of beadwork, in girdles and combs; coils of heavy brass wire are often worn on the arm below the elbow, and sometimes heavy brass anklets. The hideous lip-ring is seen rarely, but the ivory or leaden nose-pin fixed through one ala of the nose is very common.

The authority of the chief is seldom exercised without the approval

of his advisers, and is generally respected. Flocks and herds are not extensively owned by the Yaos, who, however, cultivate, in addition to the crops common to all parts of the country, rice of excellent quality, introduced from the East. Since we have demonstrated our ability and determination to control them, the Yaos are rapidly asserting themselves as valuable material for soldiers, police, and artisans.

The Achewa people, including the Achipeta, Achikamtunda, and other divisions of the same race, are of the Wanyasa or Manyanja stock,

YAO WARRIOR.

and were the owners of the country before the advent of the Angoni, at which time large numbers of them were enslaved, and now form a portion of the Angoni nation. Those who escaped death or captivity at the hands of their enemies were forced to take refuge in the almost inaccessible strongholds of their mountains, where they were in some measure able to defend themselves, although their ungarnered crops were always at the mercy of their opponents. In consequence of this continual sense of insecurity, the majority of these people have never

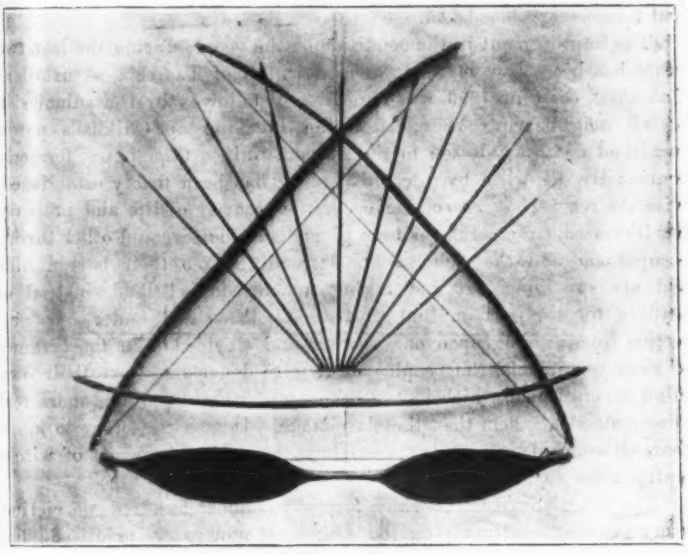
travelled more than a few miles from their strongholds, and are entirely ignorant of outside matters, and of the conditions which prevail under British protection. Their general character is marked by timidity, suspicion, and distrust, as yet little abated by the remarkable amelioration of their condition brought about by our repression of their Angoni and Yao enemies.

The Achipeta, who have still preserved their virtual independence of the Angoni, inhabit the plateau to the west, where they live strongly fortified, surrounding their villages by a series of ditches, mud walls, and palisades with entrances very few, low, and narrow, admitting only one man at a time in a stooping position. Consequently, when Angoni raiders, by force of numbers, have effected a breach in the stockades, the inhabitants, unable quickly to escape, fall a prey to their enemies. On these occasions, however, they offer so desperate a resistance, that the Angoni do not rashly engage them, preferring to harass them and capture their women and children. Their weapons are bows and arrows, the latter unfeathered, with iron or wooden points smeared with a virulent poison decocted from the strophanthus plant. They are apt in setting snares for their enemies, as by pitfalls, by fixing poisoned spikes in the paths, or by deserting an outlying village and leaving pots of poisoned beer. Their dress, which is scanty in both sexes, is composed of roughly dressed goatskins for the men, and native-woven cotton cloth for the women. They are an industrious agricultural people, and are skilled in the smelting and working of iron. They have suffered much at the hands of Yao and Angoni, and have furnished the majority of the slave-caravans passing over Nyasa to the ocean.

The government of the country under review is in the hands of the Collector of the district, who is immediately responsible for the conduct of affairs to her Majesty's Commissioner and Consul-General for the British Central Africa Protectorate. Government stations have been established at convenient places, each of which has its complement of native police. Each of these stations is visited by the Collector from time to time, when the affairs appertaining to each division are discussed and disposed of. The immediate control of the people is left, for the most part, in the hands of the native chiefs, and great pains are taken to enforce obedience to the very simple and lenient laws of the Administration in a firm but reasonable manner.

Justice is administered by means of native courts, which are in serious cases presided over by the Collector of the district. In all minor cases the recognized native chief dispenses justice to his own people, who, however, thoroughly understand that they can appeal if aggrieved to the higher authority. The justice thus meted out is not found to err on the side of severity. Almost any offence can be settled by the payment of cattle, cloth, or grain; but the old system of enslaving some or all of the defendant's family to the complainant is, of

course, disallowed. There are, no doubt, cases of injustice which do not come to our notice, but I consider such to be extremely rare—infinitely rarer than when the native chiefs administered justice unchecked, and rarer than they are when cases involving details of native life are decided by a European, necessarily imperfectly acquainted with the language and customs. A small native police force, composed of men recruited from the remoter parts of the Protectorate, is maintained to uphold the authority of the Government; but, except under



BOWS AND ARROWS OF THE ACHEWA.

extraordinary circumstances, they are not allowed to act on their own initiative.

A hut-tax of three shillings a year is levied in the more settled parts of the district, but until the country is more developed it is difficult for the natives to earn the money required of them, and equally difficult for the Administration to dispose of any large quantity of native produce received instead. At present a very small percentage of houses are required to pay taxes, which are generally arranged for by the younger men going to work in the Shire highlands. The villagers along the lake-shore are enabled to pay theirs by supplying grain to the military garrison at Fort Maguire. Taxation, even when rigidly enforced, cannot be said to be oppressive, and is in every case a lesser burden than that imposed on the people by their chiefs before the

administration of the country was established. The receipts issued on payment of taxes are much appreciated, and their meaning thoroughly understood; but it would be going too far to say that the native pays his tax willingly to assist in maintaining a Government under which he enjoys peace and security, for the simple reason that he does not estimate these blessings at their proper value. On the other hand, the fair dealing which the natives have experienced at the hands of Government officials and missionaries has aroused a certain sense of satisfaction in spite of our, to them, inexplicable abhorrence of slavery and unnecessary bloodshed.

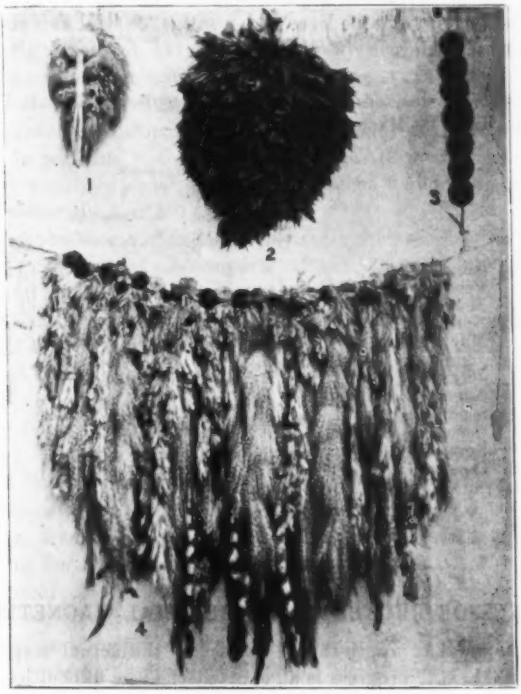
The improvement in the condition of the people during the last two years has been very marked. The downfall of Tambala, a turbulent Yao chief, early in 1896 was immediately followed by the submission of all neighbouring Yaos; later the breaking of Chikusi's power furnished a salutary lesson to the Angoni. Since then peace, formerly continually disturbed by intertribal raids, has been firmly established, with the result that, as confidence in the security of life and property has increased, an impetus has been given to agriculture and other thrifty occupations, and the Achewa are descending from their barren hills and are spreading out and taking up unoccupied land, instead of herding together for mutual protection. Prevented under our protection from preying upon one another, and shielded from the tyranny of their own chiefs, the people yet require defence against their own blind superstitions, which have in the past wrought perhaps more real misery amongst them than the slave-trade. It is satisfactory to know that, although dying hard, the inhuman branches of the art of witchcraft are not so extensively practised as formerly.

The ordeal by poison,* which formerly claimed hundreds of victims every year, especially among the Angoni, is now rarely practised; but is not likely to become extinct for at least another generation. It is an oracle which settles very definitely any vexed question, not only of the guilt or innocence of an accused person, but of the expediency of any course of action, in which latter case an animal, generally a dog, is now selected for the experiment. The efficiency of the ordeal is thoroughly believed in by every native, and in the extreme willingness with which accused persons submit themselves to it lies the chief difficulty in suppressing it.

The future of the native races herein alluded to is distinctly hopeful. The British Government, having assumed protection, has assumed at the same time obligations which can only be discharged by the most careful and judicious action on the part of the officials entrusted with

* A decoction prepared from the bark of a tree (*Erythrophlœum Guineense*, Johnston), which when drunk acts, so the natives believe, as a fatal poison or simply as an emetic according to the guilt or innocence of the accused.

administrative authority. It lies with us, in the first place, to foster the spirit of industry and thrift of which the natives have, under great disadvantages, undoubtedly shown some indications. The requirements of native life, which are imperfectly provided from his own resources, are practically confined to cloth, beads, and brass wire, considerable quantities of which were formerly obtained by the slave traffic and by a limited sale of ivory and native produce.



DRESS OF ANGONI WARRIOR: 1. SPORAN; 2. HEAD-DRESS; 3. BROW-BAND; 4. KILT.

The first of these sources of supply being now exhausted, the constant and increasing demand for labour in the Shire highlands has been in some measure satisfied, and it is certain that, as native ideas expand and wants increase, the supply of labour from Angoniland will grow larger every year, to the mutual benefit of the white man and the black. At the same time the interests of the native will require consideration. The treatment which he has received hitherto at the hands of his employers leaves little to be desired, and it should not be difficult

to frame regulations which, whilst ensuring to the native all necessary protection, cause no real inconvenience or vexation to his employer.

It is to be hoped that, as the revenue of the district increases, provision will be made for the intelligent expenditure of small sums for the maintenance of public schools and hospitals, and perhaps for the improvement of agricultural methods, principally by the introduction of suitable seeds and plants. A careful and generous consideration of native interest is likely to render abortive any incitement to insurrection of which Africa has lately furnished some unlooked-for instances, involving the loss of valuable lives and prestige, as well as a considerable expenditure of money.

The following observations have been recorded by Rev. T. C. v. B. Vlok, of the Livingstonia Mission at Mkomo Mountain :—

1897.	Thermometer.	
	Maximum.	Minimum.
January	80°	65°
February	77°	65°
March	77°	62°
April	76°	62°
May	Not observed.	Not observed.
June	" "	51°
July	" "	Not observed.
August	" "	" "
September	" "	" "
October	" "	" "
November	87°	66°
December	85°	64°

Rainfall at Mkoma, 1897, 22·34 inches.

PROFESSOR RÜCKER ON TERRESTRIAL MAGNETISM.*

When we attempt to apply theory to explain the actual magnetic condition of the Earth, progress is at once checked by difficulties, many of which have hitherto proved insuperable. We have no real knowledge of why the Earth is a magnet, no real knowledge as to why its magnetic state is continually changing, and thus we are compelled to spend long periods of time in collecting facts which, numerous as they are, are still insufficient to answer some of the simplest questions. We have a certain grasp of the facts, but have not yet found the thread of theory which binds them together. Yet attempts are being made to find such a thread, and I propose to bring forward some of the theories and speculations which are now attracting attention. The fundamental

* Abstract of 'Rede Lecture,' by Prof. A. W. Rücker, F.R.S.

facts with regard to the magnetic state of the surface of the Earth are expressed in the general result that the magnetic needle points approximately north and south, and dips from the horizon towards the magnetic poles of the Earth. The attempt to explain this result on the hypothesis of the Earth containing one or even two powerful simple magnets which control the needles on the surface fails to account for the complications of the actual facts. But, leaving this out of account, it is possible to answer some questions as to the magnetic state of the Earth without forming a clear mental picture of the causes to which that state is due.

Magnetic forces can only be produced by magnetized matter or by electric currents either within or without the substance of the globe. The first important question then is, Are the forces which act upon the compass produced within or without the globe? and, if the magnetic forces are in part due to electric currents, are all these currents wholly internal or wholly external, or do some of them flow in part within and in part without the Earth?

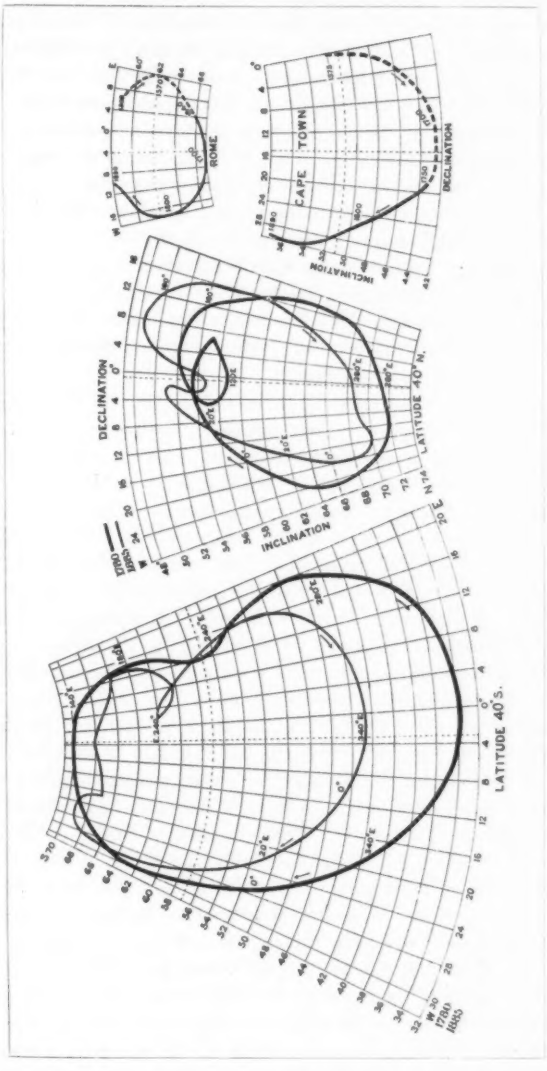
The great mathematician Gauss devised a method of determining the relative proportions of those parts of the force which are wholly external and wholly internal respectively. Dr. A. Schmidt has recently further attempted to discover whether, in addition to these, currents from earth to air or from air to earth also exist. He finds that about one-fortieth of the magnetic force is due to causes wholly external to the Earth, and that a slightly larger fraction is produced by vertical currents; the origin of the remaining thirty-eight fortieths being traced to internal causes only. The result of the calculations of Dr. Schmidt and of Dr. Bauer shows that near the equator currents pass from earth to air; in somewhat higher latitudes, from air to earth; and beyond 43° N. and 40° S., from earth to air again. Careful experiments carried out in 1895 by Dr. Carlheim-Gyllenskiöld in Sweden failed to establish definite proof of such vertical currents. Dr. Thorpe and I carried out magnetic surveys of the United Kingdom in 1886 and again in 1891, and maps have been prepared for each period, showing the vertical current for each degree-square. These maps agree in showing the strongest currents near the coasts, and that the current is from below upwards over the south-west of England, the south of Ireland, and the north of Scotland, and from above downward in the central region. In spite of this agreement, the extreme minuteness of the quantities dealt with (about one-hundredth of an ampère per square kilometre), the great variations of local magnetism due to different causes, and the individual discordance of the observations justify the assertion that there is no evidence that can be relied upon as to the existence of any flow of electric currents through the surface of the British Isles, whether from below to above or from above to below. Dr. van Rijckevorsel has lately found an upward flow through Holland

of about one-tenth of an ampère per square kilometre, but in so small an area local disturbances bulk too largely to allow of the result being satisfactory. In any case the measured currents would be much less in amount than Dr. Schmidt's theory demands. I should myself be sorry to pronounce a final opinion as to whether the theory is or is not true for the Earth as a whole, but I certainly consider that the balance of evidence is at present opposed to the physical reality of the vertical currents.

With regard to the varying elements of terrestrial magnetism, Dr. Bauer has recently suggested an interesting method of representation. He constructs a diagram of the conjoint secular variation of declination and dip by means of combined co-ordinates. He imagines the observer, with life prolonged for centuries, to be stationed at the central point of a magnet poised so that it can turn freely in any direction. Such an observer would observe, as the ages went on, that the north pole of the needle described a curve, turning now to the east, now to the west, and simultaneously rising or falling. This curve might be supposed to be registered on a vertical sheet of paper held at right angles to the geographical meridian. At most of the stations where observations have been made for more than a century, the pole of the magnet would always appear to perform its orbit in the direction of the hands of a watch, but there are a few exceptions to this rule. Although in no case have the observations been continued long enough to complete an orbit, they clearly show that the sweep of the orbit is greatest near the equator, and greater in southern than in northern latitudes, and while in Europe and Africa the curve is roughly circular, a less range in declination gives to it a more elliptical form in America. The curves for Rome and Cape Town representing corresponding north and south latitudes are reproduced in the accompanying figure. These curves embody all our knowledge as to secular change, but their diversity does not lead us to hope for definite information from them as to the duration of a complete cycle, although the calculation has been hazarded that the magnetic pole would perform an orbit round the pole of the Earth in 960 years. By a second ingenious device, Dr. Bauer points out that a needle carried round the Earth along a parallel might be supposed, on an assumed theory of the cause of terrestrial magnetism, to describe a curve identical with the complete secular cycle. The curves drawn on this assumption, though much larger, are strikingly like the observed curves in their lower parts, which correspond with the past; but in the upper parts, representing what is still the future, they exhibit curious loops and eccentricities. Two of these curves, for both the northern and southern hemisphere, in latitude 40°, are shown in the figure, side by side with the actual curves for places in similar situations.

It is interesting to compare with this speculation (which assumed a fixed and a revolving magnetic system within the Earth), Commander

Creake's induction from the comparison of Sabine's magnetic maps with those drawn by himself from the *Challenger* data. He inferred that the



CURVES OF MAGNETIC DECLINATION AND INCLINATION IN VARIOUS LATITUDES.

magnetic poles were stationary, but that at certain points on the Earth's surface the magnetic forces were increasing or diminishing.

The small diurnal variations of magnetic conditions may be studied by means of orbital diagrams in the same way as the great secular changes, but in their case the sudden and relatively large disturbances known as magnetic storms, make the determination of the normal daily orbit very difficult. The method of taking the mean of every day in the year is too laborious, but it has recently been suggested that five quiet days each month, when the conditions may be assumed to be normal, should be selected for treatment; these days are selected by the astronomer royal and observed at all English magnetic observatories. The results obtained by Dr. Chree at Kew show that the elliptical orbit described (the horizontal being much greater than the vertical displacement) is not a closed curve; and it is interesting to consider the suggestion that the failure of the needle to return quite to its original position at the end of the day is due to its secular change. Though the evidence is not conclusive, it points to the conclusion that the secular change is checked or even reversed during magnetic storms, and is consequently accelerated on quiet days.

The last subject to be referred to in this lecture is the connection between terrestrial magnetism and geology. It has long been known that local inequalities in the magnetic forces occur in different parts of the country, and the minuteness of the magnetic survey of the British Islands has made it possible to deduce the normal magnetic conditions, and so to estimate the amount of the irregularities. When these are represented on a map, it is found that there are large districts in which the disturbing horizontal forces act in the same direction; in one region the north pole of the needle will be deflected to the west, in another to the east, and, passing from one of these districts to the other, we always find that the downward vertical force acquires a maximum value at the boundary. Lines may thus be drawn on a map representing places towards which the north pole of the needle is attracted. This can be done readily and accurately. The phenomenon may be explained by the presence of large masses of basalt or other magnetic rocks, which, magnetized by the induction of the Earth's magnetic field, would attract the north pole of the needle. Where masses of basalt occur on the surface, as in Antrim, the Scottish coalfields, and North Wales, the north pole of the needle is deflected towards them at distances up to 50 miles. There are other places where local attraction is found without any appearance of basalt or other magnetic rock on the surface. It is reasonable to suppose that such rocks are there, but buried under other strata, and if this is really the case, the lines drawn on the map as those to which the north pole of the magnet is attracted represent the ridge-lines of concealed masses of magnetic rock of the existence of which the geologist may obtain no other evidence. As a rule, also, when rocks of carboniferous or pre-carboniferous nature project through newer strata and crop out on the surface, the north pole of the magnet is deflected

towards them. A striking instance of this occurs in the Pennine chain, where the denuded crest of an anticline exposes a mass of millstone grit (carboniferous) along the summit, while the flanks are covered with much younger rocks. A well-marked magnetic ridge-line runs along the chain. Similarly, in the neighbourhood of Birmingham, the Dudley and Nuneaton coalfields are surrounded by more modern deposits. A curious horseshoe-shaped ridge-line connects these two, and then runs south to Reading, which is, magnetically speaking, one of the most important towns in the kingdom. East and west from Dover to Milford Haven, and thence to Wexford, there lies a palæozoic ridge in many places deeply covered with newer deposits, and bearing the South Wales, Forest of Dean, and Dover coalfields. A magnetic ridge-line closely follows this direction, passing through Reading. Another magnetic ridge-line runs from near Reading and enters the Channel near Chichester; and the continuation of this line has been traced by M. Moureaux from the coast near Dieppe across Northern France to a point about 50 miles south of Paris. It may be hoped that such magnetic ridge-lines will be recognized as physical features of the country as permanent as the hills themselves.

CORBETT'S LIFE OF DRAKE.*

In the Elizabethan age, it was the training acquired in a life of exploration and discovery which enabled the Drakes and Frobishers, and many others, to save their country as naval officers when the time of trial came. Nor were the results of such training less important in subsequent ages, as was shown by Shovel and Keppel, Nelson and Riou, Sherard Osborn and Hamilton. The neglect of such training is one of the gravest mistakes that is made by our present naval authorities.

The life of Sir Francis Drake is one of the best illustrations of the enormous importance to the efficiency of our navy, of continuing to give our naval officers opportunities of winning distinction as explorers. For this reason we rejoice at the publication of a thoroughly good biography of our great circumnavigator, written by the light of all the new materials which have been brought to our knowledge in recent years, by Laughton, Duro, Peralta, and the Historical MSS. Commission.

Mr. Corbett has taken great pains to give his readers the most accurate account of Drake's early life that is now attainable, and has cleared away numerous mistakes of former biographers. It is a pleasant picture he enables us to fill in, of the lives of the young brothers on board the old hulk in the Medway. Mr. Corbett also furnishes us with the clearest and most correct account that has yet appeared, of the

* 'Drake and the Tudor Navy, with a History of the Rise of England as a Maritime Power.' By Julian S. Corbett. 2 vols. Longmans: 1898.

Spanish treachery at the San Juan de Ulua, an event which was long made puzzling and obscure by the blunders of his predecessors. But our gratitude is chiefly due to Mr. Corbett for showing that the 'Sir Francis Drake revived' is an authentic work, in spite of Mr. Froude's harsh and erroneous judgment. Mr. Corbett has found that the main statements contained in it are corroborated by Spanish reports. This is important, because 'Sir Francis Drake revived' is almost the sole authority for the most romantic part of the illustrious explorer's career. Mr. Corbett also clears up a great deal that was obscure in the Doughty business; and his arguments are quite conclusive respecting the discovery of the Cape Horn route. He very properly makes full use of the Zarate letter, which throws so much light on the internal economy of Drake's ship. We are indebted for the discovery of this letter, in the Seville Archives, to our good friend, Señor Peralta, who has also done so much excellent work connected with the history and anthropology of Central America.

Geographers will welcome the first volume of Mr. Corbett's important work as the best and most valuable biography of our illustrious circumnavigator, during the period that he was doing able and memorable service for geography.

The second volume is devoted to Sir Francis Drake's naval career, and here Mr. Corbett has done good service to the history of cartography, by the reproduction of the maps which were engraved to illustrate the 'Summary and True Discourse,' and of Adams's charts of the various actions in the channel with the Spanish fleet. The latter were published in the 'Discourse concerning the Spanish Fleet invading England' (1590), and are exceedingly interesting. Their execution reminds us of some of the work of engravers employed on Saxton's atlas, who were, no doubt, also employed to execute the Adams charts.

ON SEA-BEACHES AND SANDBANKS.*

By VAUGHAN CORNISH, M.Sc. (Vict. Univ.), F.C.S., F.R.G.S.

§ 1. Scope of the Investigation.

This paper is the sequel to one on "The Formation of Sand-dunes" in the *Geographical Journal*, March, 1897. It embodies a research upon the processes which distribute the detritus which enters the sea at its margin, and upon the behaviour of the material distributed. I have again given special attention to the peculiarities of mixed multitudes, some of which provided a key to much that was obscure in the behaviour of sand-dunes. As the research progresses this aspect of the phenomena acquires an increasing interest, and I hope to apply the results obtained in the study of dunes and beaches to other aggregates.

I have to acknowledge many valuable suggestions received during the preparation of the present paper from Dr. H. R. Mill, F.R.S.E., and Mr. Clement Reid, F.G.S.

* Paper read at the Royal Geographical Society, March 16, 1898.

I have also to thank Prof. G. H. Darwin, F.R.S., for information upon tides; Mr. F. E. Lacey, M.I.C.E., for the section of the Bournemouth beach; and Prof. J. Walther, of Jena, and Mr. W. Whitaker, F.R.S., for references to literature.

§ 2. The Motions of the Bottom Water of the Sea.

(*For Breakers, see* § 5; *and for further discussion of the Tides, see* § 14.)

(*a*) Circulation.—From the western tropical coasts of Africa and America the persistent south-east and north-east trade winds cause a surface drift towards the eastern coasts of America and Asia respectively. The southern is the watery hemisphere, and the shores of the Atlantic and of the Pacific converge in northern latitudes, the continents widening, and the oceans contracting. Wholly or partly on account of this circumstance, the surface drift of the south-east trades pours over into the region of the north-east trades, and the resulting surface drift of these co-operating winds is on the whole northerly—markedly so in the Atlantic. The waters of the Atlantic are piled up before the wind on the east coasts of the Americas, while under the west coast of Africa the water is constantly renewed, partly by coastal currents, and partly by a welling-up of water from below under the windward shore.* Such welling-up from below in off-shore winds has been repeatedly demonstrated by observations of saltness and temperature.† On the other hand, the driving of a surface current against a lee shore raises the level of the sea there to such an extent that gravity causes the lower layers of water, where the drag of the wind is slight, to flow back from the shore. Such is probably the cause of flow of the Gulf Stream in the earlier part of its course. This kind of reverse current may be compared to the effects of polarization in electrolytic phenomena. The great north-easterly drift across the Atlantic, which still goes by the name of Gulf Stream, is probably of mixed origin, being partly the reverse (polarization) current flowing on by its momentum, and partly a surface drift due to the south-westerly winds which prevail in these latitudes. Such surface drift before westerly winds, when piled up against the western shores of Europe, is capable of producing a reverse bottom current or undertow flowing off-shore.

When the area over which a wind acts is small relatively to the size of the sheet of water, or when a part of the water is sheltered, *e.g.* by a headland, the return current may principally flow by the side of the drift instead of underneath. There is, besides the polarization current due to gravity, a second sort of reverse current, viz. the *induction currents* (induced by viscosity), which, with eddies interposed as friction wheels, flow parallel with and in the opposite sense to the primary ocean currents.

The great drifts of surface water which flow from the more open to the narrower parts of the oceans, and from the southern and equatorial to the northern latitudes, are for the most part broad rivers between banks of water in the open ocean, whilst the induction currents which flow in the reverse sense often hug the shore. Here, therefore, as in the case of the polarization currents, *the motion which affects the sea bottom has the reverse direction to the main drift of the surface water*. In the case of along-shore winds, however, acting on the shallow water within the breaker-line, the bottom drag is in the direction of the wind, and there are other particular cases in which this is so (see § 8).

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* See J. Y. Buchanan on "The Guinea and Equatorial Currents" (*Geographical Journal*, March, 1896).

† See, for example, F. L. Ekman on "The Causes of Ocean Currents" (Royal Soc. of Upsala, May 30, 1876); and H. R. Mill on "The Clyde Sea-area" (*Trans. Roy. Soc. Ed.*, vol. xxxvi.).

A river flowing into the sea as a surface current of light water creates an induction current* of sea-water which flows landwards under the outflowing water, so that in this case there is a bottom motion in a sense opposite to the surface current. Another important case is that illustrated by the exchange of waters between the Atlantic and the Mediterranean. There is a flow of surface water from the Atlantic to the Mediterranean, but evaporation has made the Mediterranean water salter and heavier than that of the Atlantic, and at greater depths the pressure of the Mediterranean column appears to be more than sufficient to counterbalance that of the column of Atlantic water. The bottom current flows from the enclosed sea towards the open ocean in a strong stream, the flow of which is perhaps assisted by an induction (as of rivers). In the North Sea, on the other hand, the waters of which are lighter than those of the Atlantic, the latter encroach or recede under the varying conditions; but it is important to note that an encroachment of Atlantic water, commencing as a surface drift, becomes an undercurrent by the gradual sinking of the heavier water, which pushes its way as a submerged wedge.† This is still more marked in the case of the encroachment of salter water into the Baltic. The lighter water escapes as a surface current.

From a region of cold and condensation (as the north polar sea), the outflowing water may escape in a current which extends from top to bottom of the sea, for the bottom layers are dense owing to the low temperature and concentration of salt, and the surface waters, although fresher, slope downwards towards the areas of evaporation.

The surface current of a *frozen* sea and the current of a debouching river are two cases in which the surface waters are directly concerned in the transport of detritus. The general character of the observed surface flow of oceanic water, as well as the observations of deep-sea temperature in equatorial regions, afford evidence of a slow creep of bottom water from the polar to the equatorial and trade-wind seas, where it ascends to supply the water lost by evaporation. From our present point of view (that of transport of marginal detritus) we are not much concerned to discriminate between water which flows to the pole as surface drift before the poleward winds and that which reaches the poles by distillation.

From the above considerations, it appears that, on the whole, *the quantity of motion of the bottom water of the sea is greater off-shore and oceanwards than in the reverse direction, especially within the limits where wave-action reaches the sea-bottom, but a local exception to this general rule occurs beneath those river waters which flow seawards as a surface current.*

It is solely for the sake of this proposition that the discussion of ocean currents has been introduced here; the author makes no claim to have added anything to the knowledge of ocean currents.

(*b*) THE OSCILLATION OF THE SEA. *Tides.*—The action of the sun and moon in creating tidal agitation is chiefly effective in the broad oceans, particularly in the encircling waters of the southern hemisphere. Tidal agitation in the narrow seas is chiefly due to the push originating in a difference of level, and transmitted by the agency of the Earth's gravity. Tidal agitation is supposed to be equal from the surface to the bottom, and to be transmitted as a "long wave" in which, practically, all the motion takes place in the direction of transmission, so that, except for the effects of friction and viscosity, the energy of each swing is perfectly transmitted. Thus the violence or intensity of the movement of water is increased in

* See, for example, the researches of Ekman, Mill, and Petterson.

† See H. N. Dickson, Reports, Fishery Board of Scotland.

proportion to the diminution of the quantity available for the transmission of this energy. Consequently, the oscillating currents become swifter where the waterway is contracted by converging coasts or by a submarine ledge.

Where the waterway is stopped, as for instance at the head of an inlet, the water continues to pile itself up against the coast until the *head* counterbalances the momentum of the oncoming current.* This piling up may cause an undercurrent off shore before the time of high tide. The waters of a bay at low tide are, however, often comparatively fresh, owing to the outletting of river waters; the incoming salter waters of the flood will therefore, in such cases, tend to burrow under in the form of a wedge, and the distribution of pressure may be such that, if water escapes during the incoming tide, it will rather be as a surface current.

The undisturbed run of a tidal current is a simple harmonic motion of twelve hours' period, but at any locality to which the tidal push is transmitted by two different paths, the movement of the waters is compounded of two simple harmonic motions of equal period, but generally differing in amplitude, and which may have any difference of phase. The most usual character of the resulting motion is rotation in an ellipse. Such rotation is produced where the straight run of the tides in a channel compounds with the on-and-off-shore swing in and out of a bay. The well-known longer-period oscillation combines in some localities to create a very great difference, and in others but a slight difference, to the range of the spring and neap tides respectively. The most rapid tidal currents run along shore (particularly off headlands), the on-and-off-shore currents being comparatively slow. The on-shore current during rising tide is generally more rapid than the off-shore current of the ebb, the latter lasting a longer time. The extreme case of this difference of intensity is reached in the bore of rivers.

To sum up, *the bottom agitation due to tides is greater near the shore, and in channels and in narrow seas, but probably extends, though with diminished force, to the bottom of the deep oceans. This variation of force as we proceed oceanwards is not, however, uniform, but is interrupted by nodes and loops* (see § 14).

Waves (outside the Breaker-line).—The oscillation of the water due to waves raised by wind decreases in geometrical progression as the depth below the surface increases in arithmetical progression (which is the usual law of decrease for cases of radiation), so that the agitation of even the largest recorded waves only disturbs the bottom water appreciably within a depth of about 150 fathoms. The movement of the surface water in a ground-swell is uniform rotation in a circle, which is equivalent to two equal harmonic motions, the first forwards and backwards in the direction in which the wave travels, the second an up-and-down motion. The forward motion takes place on the higher level, so that at each revolution half the energy of motion is transmitted forwards.† Not far from the bottom the motion corresponding to this surface movement is (nearly) a simple harmonic horizontal oscillation. The complicated movements quite close to a rough bottom are dealt with in the next subsection. When the swell reaches the shallows of the shore, the depth being small compared with the wave-length, it is easily observed that the front of the wave becomes steeper and the back flatter. In proportion as the form of the surface departs from the symmetrical curve of sines, which is the form of the ground-swell in deep water, so does the motion of the water near the bottom depart from the

* See, *e.g.*, O. J. Lodge, Brit. Assoc., 'Handbook to Liverpool' (1896), p. 101.

† Osborne Reynolds, *Nature*, vol. xvi., 1877, p. 343: "On the Rate of Progression of Groups of Waves."

perfect balance of the harmonic oscillation. The forward motion is sharp and short, and the water is brought back to its former position by a slower motion lasting a longer time. The retardation of the wave-front in shallow water causes the swell to advance almost dead on shore; consequently the strongest oscillating bottom currents caused by the swell are on-and-off-shore, not along-shore, as in the case of the strongest tide-currents. It is to be noted that the bottom action of the waves becomes more intense the nearer we approach the shore. Again, since the depth to which wave-agitation extends depends primarily upon the wave-length, and only to a secondary degree upon the amplitude, long flat swells * (the dying waves of an ocean storm often almost invisible at sea) will stir the water at depths which would remain unaffected by high but short waves raised not far from the coast by an off-shore wind. Thus it is the oscillation due to the waves travelling shorewards which chiefly affects the motion of the water near the bottom. Similarly, the deeper waters of a channel (such as the English Channel) are more affected by a long swell from the ocean than by shorter waves running oceanwards from, *e.g.*, the North Sea, even if the latter be somewhat higher.

If the margin of the sea be a cliff of rigid rock rising out of deep water, the energy transmitted shorewards by the swell is reflected back upon its path, and the difference of character between the on-shore and off-shore movement of the water is to a great extent obliterated, whilst the intensity of the agitation is increased.

To sum up, *the bottom oscillation of the sea due to the waves, decreases very rapidly from the shore seawards, and ceases altogether near the summit of the continental slope; near the coasts the oscillation is mainly on-and-off shore, and the shoreward component of the oscillation is short and sharp, the seaward longer and slower.*

Seasonal Oscillation.—In addition to tides and waves, there is a third kind of periodical reversible disturbance to which the waters of the sea are subject, corresponding to the annual cycle of the seasons. This long-period disturbance superposes a noticeable twelve-monthly oscillation upon the circulation of some parts of the sea, *e.g.* in the regions of monsoons, and where the waters of the sea, or even those of the rivers only, freeze in winter.

(*c*) On the Motion of Water near a Rough Bottom.—When the velocity of a current is being retarded by the roughness of the bottom, bodies of swirling water continually rise from the bottom, especially from the lee side of obstructions. There is thus a constant upward motion of the bottom layer, *the buoyancy of which is increased, whilst its speed is diminished.*

The conditions where water is retarded by roughness of bottom are similar to those which obtain when a tidal current is gaining strength. In a succeeding portion with a smooth bottom there is a continuous settlement of water, and this corresponds to the conditions when tidal current is slackening. When the main body of water is agitated by an harmonic motion, such as nearly corresponds to the agitation communicated to the depths by the swell, the layer of water close to the rough bottom divides itself into regular segments, in which the water has alternately a motion with an upward component and a motion with a downward component; † in the latter the water settles, and in the former it is constantly pumped up, the balance being of course maintained by other currents. An important feature in the character of the bottom motion of water thus agitated is the high intensity momentarily obtained by the *upward* swirls. This is readily seen by the dance of the sand-grains when a glass trough containing water over a layer of sand is rocked to and fro.

* See Sir G. Stokes, 'Memorandum on Waves.'

† See G. H. Darwin, "On Ripple Mark" (*Proc. Roy. Soc.*, 1883).

§ 3. Mud Flats of the Deep Sea.

A regular oscillation or an indiscriminate agitation which rolls or drags a heavy body alternately uphill and downhill results in a downhill travel of the body, owing to the action of gravity. It is well known that mud travels persistently from the shore seawards, and that it forms the bottom over vast tracts beneath deep-sea water, *e.g.* at the foot of the continental slope, and in such positions as the depths of the Mediterranean, and the holes or pockets in the Baltic. Mud, however, settles with such extreme slowness, that wherever the bottom is disturbed by waves (say, to the edge of the continental shelf) it cannot anchor itself upon the bottom even during the slack water of the tides, so that the above-described action of gravity is effectually cheated. This leads to the conclusion that *the transit of mud down the slope from the shore is not due to the action of gravity.* That mud rests and accumulates at the foot of the continental slope, for instance, is due to the fact that the increased depth has removed the bottom from the disturbance of wave-action. Here at length gravity becomes effective, and brings down the mud. Were the waves of the sea to originate from the bottom, as do the standing waves of stony brooks, and to decrease in intensity towards the surface, gravity would oppose scarcely any resistance to the transport of the mud from the foot to the top even of the continental slope, and it would be in the still water on the top that the mud would settle. In like manner, the activity of a housemaid raises the dust from the floor of one's study to settle quietly upon the tops of pictures and bookcases.

It appears, then, that *the principal factor determining the well-known direction of mud-transport is the diminution of intensity of bottom agitation from the shallows to the depths.* The effects of diminishing intensity must be exemplified further in this place, for there are cases where the reverse effect is produced, the finest material seeking the positions of greatest agitation.* Such cases are the wake of dust which follows a railway train, and the cloud of lycopodium powder which, unable to disentangle itself from the swirling air above a metal plate which has been set in vibration, deposits at the positions where the agitation has been greatest. These are instances of agitation with intervals of complete quiescence. When, on the contrary (as *e.g.* within the limits of wave-action), the agitation is practically incessant, dust slowly shifts away from the area of agitation, as in the winnowing of chaff from a heap of grain.

The mud which is transported from the shore, and that which is produced on the bottom of the sea, is not restricted to a thin layer close to the bottom. Presumably, the sea within the area where wave-action extends to the bottom, bears throughout its whole depth, though in greatest quantity near the bottom, a haze of dancing dust such as a sunbeam reveals in the air. Conversely, the agitated water bearing this flying haze never covers a muddy bottom, except where the mud is being produced upon the spot, *e.g.* by the disintegration of a clayey rock; † or, occasionally, where water is stilled beneath an entanglement of waving seaweed.‡

The prevailing off-shore movement of the bottom water of the sea renders it probable that terrigenous mud is slowly transported oceanwards from the foot of the continental slope. The limit of transport is likely to be considerably beyond the limit to which the materials have been traced, for where the material is in but small proportion its presence is masked.

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* See Faraday (*Phil. Trans.*, 1831) on "Acoustic Figures."

† See Delesse, 'Lithologie des Fonds des Mers,' p. 285.

‡ See Ch. Barrois in *An. Soc. Geol. du Nord*, t. xxiv., December 2, 1896, pp. 196, 197.

§ 4. The Sorting of Sand from Shingle and from Mud.

Let the velocities of water required to move shingle (pebble) and sand be respectively—

Velocity for shingle (Vp)
Velocity for sand (Vs)

To fix our ideas, we may suppose for the moment that $Vp = 48$ inches per second, and $Vs = 12$ inches per second.* If we take a simultaneous view of the various modes of motion of the waters of the sea described in § 2, we shall see that *the usual condition of sea-water is one of oscillation* which is not quite symmetrical in amount (*i.e.* there is often a prevailing set in one direction), and *which is scarcely ever symmetrical in intensity, a short quick motion one way being balanced, as far as the movement of the water itself is concerned, by a long slow motion in the reverse direction.* Taking the later case, where there is no drift of the water, *let the maximum shoreward velocity be Vp, and the maximum seaward velocity be Vs, then the sand will be moved to and fro, but the shingle will travel in one direction only,* viz. shoreward, its progress being by a series of jerks.

If the duration of the backward swing at maximum velocity *Vs be increased,* so that there is a general drift of the water seaward, *the sand will travel seaward, whilst the shingle continues to travel shoreward.* Simultaneous transport in opposite directions is achieved without any drift of water when the sea-bottom slopes in the direction of the smaller velocity (in this case seaward). Shingle of 2 inches diameter sinks at the rate of about 24 inches per second, sand at about 2 inches per second. As, also, the shingle is generally only raised a small height from the bottom by the movement of the water, gravity has a much longer time to act on the sand. It follows that gravity has much more influence upon the rate of transport of sand than upon that of shingle. In the above case, the only effect of gravity on the motion of the shingle is to cause its (shoreward) path to be very slightly shorter. The sand, if the velocity of the onshore swing and the rate of reversal permit it to come to anchor between the two parts of the oscillation, will have its shoreward path appreciably shortened, and its seaward path appreciably lengthened. Thus *suitable oscillation on a seaward slope will set shingle travelling shoreward, and sand simultaneously travelling seaward.* If the velocity on the seaward half-swing of an oscillation be as great as Vp, the shingle is moved both ways, and is liable to travel seaward if the bottom slope from the shore.

The condition of the transport of shingle (great intensity of motion) keeps most of it close against the shore, often in a bank or beach; while the inability of mud to settle except where the water is quiet causes it, as we have seen, to accumulate in mud flats beyond the limits of wave-action. The accumulations of sand are of greater variety, for, although the mean term in size, it possesses a greater *independence of motion,* or persistence, or effective inertia, than either of the extreme terms. Mud (by which I intend throughout such characteristic marine mud as the well-known "blue mud") obeys each slightest swirl of the water; it follows almost exactly the stream-lines; and it is only in the slow settlement of the mud in still water that muddy water behaves otherwise than as an emulsion. Shingle, again, is not raised to any great height from the bottom, and sinks so swiftly that it does not take a long free flight in water. Hence, when it is moving it follows almost precisely the direction of the momentary movement of the water. Sand, on the other hand, is frequently churned up to a considerable height from the bottom, and

* See, for example, Wheeler, 'Tidal Rivers,' pp. 67, 68, quoting T. Logan for nearly similar figures. Also see Rankine, 'Manual of Civil Engineering' (1862), p. 708 (on the authority of Dubuat).

often has a long free path; and when the stream-lines of the water are suddenly deflected, whether vertically or horizontally, inertia carries the sand on, the stream lines of the sand being deflected less than those of the water. Similarly, when the current slackens the sand flings itself forwards, as is so noticeable in the rippling of sand by waves. *It is owing to its persistent motion that sea-sand accumulates in vast Banks where it is flung by the sudden bending or checking of currents* (e.g. *at tidal modes*), *or where it is dropped during tumultuous mixing of waters.*

§ 5. The Making of a Shingle Beach.

(*a*) The Breaker.—If waves be transmitted without breaking (*e.g.* oily waves) towards a sloping shore formed of hard, impervious rock, the oily sea will wash up and down the slope of the shore between two lines, which are near the respective levels of the trough and the crest of the waves. If sand or pebble be placed upon the slope, this oscillation will enable gravity to bring such sand or pebble down to the foot of the slope. The wash of the sea is, however, complicated by the breaking of the wave. The water in the front of the breaker rises slowly. The water of the cusp, at the moment when it trembles to its fall, is moving somewhat rapidly forwards. The fall of the water is that of a body falling freely, and the downward velocity increases so that the last part of the fall of a large breaker is at a fairly high speed, probably not very different from what might be calculated in the ordinary way from the height of fall. The water is also moving forwards. The angle at which the water comes down varies according as the wind is off-shore (steeper), onshore (more sloping), and with other conditions. On a steep coast, this water often falls on the bare shore; it has then considerable power to push forward loose material. On a gently sloping shore, the breaker generally falls upon a cushion of water, which is, moreover, at this moment frequently moving seawards. The position of most intense motion in the breaker is usually not the falling front, but just behind, where, as the front falls, the water is swirled upward and forward with a surprising intensity of motion, which extends to the very bottom, and brings a rush of water over the fallen front. In point of fact, the breaker is usually, as it is sometimes called, a roller. In the transport of material, both the push of the fallen front and the jerk of the rising back act shoreward. That which we have just described is the whole *of the breaker proper; the bottom action is wholly shoreward*, and the intensity of motion which is attained at the critical moment is probably greater than any intensity of bottom motion attained in the sea except in tide-races.

(*b*) The Wash of the Waves.—The breaker flings and drives materials forward into the wash. On a sloping platform of impervious rock, the wash treats these materials as has been described above, viz. shakes them down again into the sea. The only marked difference is that occasionally the momentum of a flying pebble carries it further than the wash of the water. On the rocky platform at the base of a hard cliff, the boulders, when reduced to such size that the sea can roll them, are removed from the foreshore. This action is assisted at high tides by the resurging of the wash from the cliff foot.

Where the foreshore is composed of shingle, the proper work of the breaker continues as above, viz. the casting up of shingle, etc., for the wash to deal with; but the action of the wash is entirely different owing to *percolation*.* The rise and fall of water without breakers on a shingle beach would be simply a welling up and a sinking down through the shingle. But the advance of the sea upon the

* Compare A. R. Hunt, F.G.S., "On the Action of Waves on Sea-Beaches and Sea-Bottoms" (*Proc. Roy. Soc. Dublin*, vol. iv. part vi. p. 267).

beach taking place, not by the welling up of water, but by the discharge of a breaker, the on-wash runs over the surface of the beach, the water gradually filling up the interstices as it goes *and depositing its burden of shingle*, for, this being the same kind of material as that of which the beach is composed, the water cannot carry it down through the interstices. So much for what happens during rise of level. When the momentum of the on-wash is exhausted (the level of the sea at the breaker-line being also, as a rule, lowered so that the wash-water is no longer supported hydrostatically), the wash-water flows back in the following manner: viz. a considerable part sinks down through the shingle, and can thus no more carry back the new material from the surface than the liquid which trickles through any other filter can carry a precipitate with it; the remainder of the water runs back over the stony surface. The quantity of water flowing back over the surface being thus diminished by percolation, its impulse is correspondingly diminished, and *the depth of the stream being decreased, the resistance of those pebbles which are not wholly immersed is greatly increased.*

Thus the wash of the waves, owing to percolation, piles up the pebbles thrown forward by the breaker, forming a bank, or ridge, or Full, and this is the action proper to the sea on a shore of shingle.

(c) THE SHINGLE *Full.*—The piling up of the ridge goes on, its height and steepness increasing, until the wash can reach no higher, and the steepness of the ridge at each point is such that the assistance which gravity gives to the down-flowing surface stream counterbalances the loss of transporting power due to percolation at that level.* This is the equilibrium profile or regimen of the *Full.* Now, *the greater the volume of water flung forward by the breaker, the greater is the depth of the back-flowing surface stream, and thus for the same size of beach material the carrying power of the back-wash is more nearly equal to that of the on-wash. Consequently, in a given locality, the regimen slope of beach proper to a rough sea is not so steep as that for a quiet sea.* Hence (partly) the common observation that the first effect of larger waves is to "cut into the beach," an operation which consists in flattening and lengthening the slope of so much of the existing beach ridge, or *Full*, as the waves at the time are able to get at. If the stronger waves continue for a sufficient time, it will be found that their action is not different in kind from that of the gentler waves, for, after trimming down the seaward face of the old *Full*, they will proceed to construct a *Full* for themselves, at the top of which accumulation will proceed by percolation, until the *Full* has attained the maximum height to which the wash can reach. The sea face of this *Full* is longer and flatter than that given by a calmer sea. Practically, as heavy seas on our coasts do not continue for long, the equilibrium form due to such seas is comparatively seldom seen, and the initial stage of cutting into a steep beach-ridge is often mistaken for a real change from on-shore to off-shore action.

There is, however, a real removal of the beach by storms, as well as the mere temporary effect above described, due to the fact that the wind is more or less on-shore. The breaker is modified by the hurrying forward of the crest and by the undertow. The waves break further out, and the crest falls upon a cushion of water, and hence has less power to push shingle before it; the shoreward motion of the water at the foot of the falling breaker is less, or in extreme cases the motion

* Compare A. R. Hunt (*loc. cit.*), as follows: "It will be noted that the absorptive power of the shingle increases gradually from the margin of repose, where it is *nil*, owing to the shingle being saturated, to the point of furthest reach, where it may be perfect; and that absorption alone would suffice to account for a gradually increasing curve in the profile of a beach above the margin of repose."

here may actually be seaward,* consequently less shingle is brought by the breaker than would otherwise be the case. These modifications diminish the amount of material deposited on the beach by the on-wash, whilst the work of the back-wash is assisted by the undertow.† As we proceed seaward the intensity of the bottom agitation diminishes, and at length the rate of the undertow, added to the rate due to the wave-motion propagated from the surface, no longer produces a seaward current equal to the critical velocity which we have called V_p, and the shingle gets no further seaward. Indeed, it seems that this action usually takes the shingle only a little way out, and that it is soon brought back again during off-shore winds, or even by the unaided operation of a moderate swell. Even in light on-shore wind, when the sea is only slightly agitated, shingle may be restored to the beach, for, the maximum velocity attained on the seaward swing of the wave just outside the breaker-line being less than the critical velocity V_p, the shingle will be fed into the breaker instead of being abstracted, and by it will be flung upon the beach.

When storms are accompanied by very high water (*e.g.* as with south-westerly winds in the English Channel at spring tides, or during north-westerly winds on the east coast of England), shingle in many localities may be removed from the beach whether the wind be somewhat on-shore, as in the former, or somewhat off-shore, as in the latter case. This is frequently due, not to the proper mode of action of the sea upon the shingle bottom, but to the circumstance that at such time the sea in many localities reaches some wall or obstruction from which the wash surges back. Where, however, there is no such obstruction to the proper action of the sea, much of the shingle removed from the seaward face of the shingle barrier is flung over the top, and the barrier is increased in height and pushed shorewards. In this way shingle swept from the foot of cliffs protects the neighbouring flat coasts.

(*d*) On the Action of Sea Defences upon Shingle.—Although a natural barrier of shingle is capable of providing a defence against the flooding of low-lying land, this is conditional upon the shingle being free to travel shoreward in stormy weather. Moreover, at such times the erosion of the sea-bottom seaward of the beach, which is really a slow waste of the land, pushes landward the proper and stable position of the beach. Thus, unless shingle be supplied in such quantity as to produce a shingle Ness or foreland, the barrier is not fixed in position, although it be stable. Now, the first step taken in the "development" of an English watering-place on a lowlying coast, is usually the erection of a row of houses on the sea-front, with a parade abutting upon the beach. Thus having fixed for all time the line of the coast, the community is presently compelled to erect a sea-wall to stop the advance of the sea and its natural moving barrier of shingle. The consequence is, in many cases, that the beach, which contributes so much to the natural charm of the spot, is swept away by the back-wash from the wall, and the town is then situated on a small and mean artificial cliff, which is constantly being undermined. Unsightly groynes are then erected to hinder the removal of the shingle, and now it often becomes impossible even to take a walk upon the strand owing to the difference in level of the shingle on the two sides of the groynes, or, in other cases, owing to the groyne having failed altogether of its purpose, and having no bank of shingle against it on either side.

On a sandy coast, the consequences of building too close to the shore are scarcely

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* See G. B. Airy, "Tides and Waves" ('Encycl. Metropolitana').

† The backward wash is sometimes spoken of as "the undertow." For distinctness it should be mentioned here that in what follows about undertow, I am referring to a seaward motion from the back of the breaker. Seaward motion on the land side of this I refer to as the backwash.

less disastrous to those natural beauties which are so important an element in the prosperity of a watering-place. As almost every promising spot on the English coasts is already either a watering-place or destined by the owners of land to become one, it may not be amiss to point out that a lengthened preservation of the present natural beauties is only to be attained by fixing the building front as far from the shore-line as is consistent with a good view of and ready access to the sea. Moreover, when a watering-place has developed into a populous and closely built town, the benefit of pure sea-air can only be obtained on the strip in front of the first-built row of houses. This strip should therefore be as wide as possible.

§ 6. On the Ridge-and-Furrow Structure of a Shingle Ness.

Where the surplus income of shingle exceeds the loss by attrition, the shingle tract grows seaward. The surface of this tract is usually laid down in ridge and furrow ranged parallel to the sea-front. The greater the tidal range, and the more marked the difference between the levels reached at neap tide and at spring tide, the more distinctly will a seaward-growing beach show the ridge-and-furrow structure. Thus during neap tide there may be formed a *Full* so large that at the succeeding higher tides it is only rolled a short distance shorewards, not far enough to amalgamate it with the last spring tide *Full*. Similar conditions apply to the aggregated bank called the summer *Full*, and its amalgamation, or non-amalgamation, with the *Full* of the previous winter. The larger the *Full* the slower it travels; its condition of stability may be defined much in the same way as those of a desert dune. An embryo *Full*, as an embryo dune, may (1) be destroyed; (2) may be hurried into coalescence with an older, larger, and slower-moving *Full*; or (3) may in rare instances grow until it possesses the permanence and immobility which size alone can give to an aggregate of incoherent material. Thus, instead of coalescing, the larger *Fulls* remain isolated from one another, and we have the ridge-and-furrow structure (which is shown, *e.g.*, on the map of Dungeness, Sheet 4, Geological Survey, reproduced in Dr. Gulliver's paper in *Geographical Journal*, May, 1897, p. 541). It has been observed at Orford Ness,* and Dungeness, and at Langley Point,† that there is a rise in the level of the shingle towards the present shore-line. It is unnecessary to invoke upheaval or subsidence to account for such difference of level, for as a Ness grows out into the tideway it offers increased obstruction to the coastal currents, the momentum of which will consequently bank up the water to a higher level, and the elevation attained by successive Fulls will therefore continually increase.

§ 7. The Along-shore Drift of Beach Shingle.

(*a*) The Action of Oblique Breakers.—On a steep shore, obliquely running waves break before they have time to swing round so as completely to face the shore, so that along-shore wind gives obliquely acting breakers. On a gently sloping shore, and with an ocean swell, the wave swings round almost parallel to the shore before breaking, and the line of action is therefore at right angles to the shore, or nearly so. But although one wave cannot give a very oblique breaker on a shallow shore, *two* waves can. With the wind along-shore there are generally two principal sets of waves running, viz. the set which runs straight for the shore, coming in from the offing, and the set which travels nearly parallel to the shore, running before the wind. In deep water the waves of these two sets pass through each other, their interference being momentary

* Redman, *Min. Proc. Inst. C.E.*, 1865, vol. 23.

† Topley, 'Mem. Geol. Survey,' Weald, p. 314.

and not in any way hindering the transmission by each of its proper impulse in the direct line of its motion. But the depth in which water breaks depends upon the height of the billow; consequently, when these two sets of waves are running, the combined billow formed by the coincidence of the two crests breaks before the time proper to the along-shore wave, and therefore before it can swing round to face the shore. The depths in the combined troughs being correspondingly diminished, the water there does not break. At the moment of breaking of the combined crests, the water simultaneously receives two impulses, one directly on-shore, and the other very oblique to the shore. There is no longer sufficient depth of water in front to transmit these two impulses, and instead there is a projection of the water in the direction of their mechanical resultant. The result is the rapid succession of the *short* breaker in the direction shown in Fig. 1. Under a sheltering headland the lateral waves which run before the wind are small, and only serve to serrate the crest of the wave which comes from the offing.

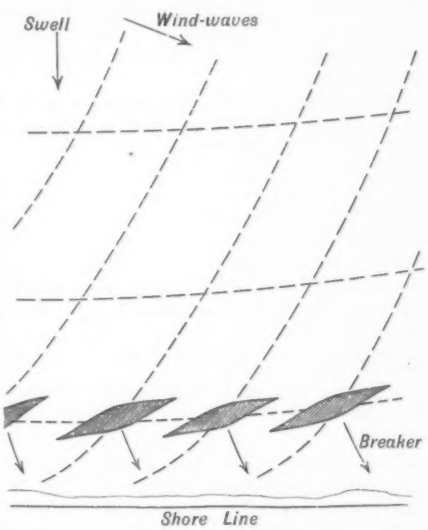


FIG. 1.—WAVES COMPOUNDING TO FORM OBLIQUE BREAKERS.

(*b*) THE DRAG OF THE WIND.—The drag exercised by wind upon the sea bottom is nowhere else so strong as in the shallow wash of the waves * with a breeze blowing along-shore, where its power is beautifully illustrated by the rippling of the froth which floats within the breaker-line. The swing given by wind to the water of the wash is easily seen. The bottom drag of the along-shore wind is also considerable at the small depth where the waves break. Here incessant agitation keeps the shingle constantly on the move, buoyed by upward swirls, so that the drift of the water before the wind can influence its motion.

(*c*) WIND CO-OPERATING WITH CHANGE OF SEA-LEVEL.—It is evident that the greatest amount of transport can occur when the sea acts upon the greatest quantity of shingle—that is to say, when the sea is at its highest level. The transporting power increases in a more rapid ratio than the rise of level, owing to the circumstance that most of the shingle is accumulated on the landward side of the beach, where its thickness is greatest. It follows that a wind blowing in the direction of the flood tide will have an advantage in shingle-transport over the wind which blows with the ebb, for the former, by opposing the turn of the tide, tends to increase the duration of tidal high water, and to diminish the duration of tidal low water. *Thus, although the forces of currents may be equal and opposite in the two cases,*

* Compare remarks by Sir George Nares, *Min. Proc. Inst. C.E.*, cxxv., 1895–6, pt. iii. p. 36.

the opportunities of action on shingle are greater when the wind blows with the flood tide. Again, the waves break most violently on the steep beach near high-tide mark, which further increases the effect of prolonged high water in promoting transport. The along-shore wind which is accompanied by a low barometer has a corresponding advantage of opportunity over the along-shore wind which is accompanied by a high barometer, and the wind along-shore which blows from the greater expanse of water over the wind which blows from the less.

It is necessary to guard against the assumption that the greatest amount of shingle transport is, at every point of the coast, in the direction of action of the more potent forces. For let us consider the case where a beach receives a large supply of detritus of a certain kind at, say, the north end, and a small supply of the same kind of detritus at the south end. Between these ends the tide ebbs and flows, and the winds are sometimes north and sometimes south. Let the forces acting from the south be slightly the more potent; then, *since the difference of forces is small and the difference of quantities is great, there may be a greater transport in the direction of action of the smaller force, since the motion of the water is oscillatory.*

(*d*) Shingle Spits.—The along-shore drift of beach shingle often extends a shore beach as a shingle spit projecting between sea and calm water at the entrance of rivers and estuaries. The permanence of these spits may well excite surprise, considering their apparent liability to be swept bodily away. Their safety is in the opportunity they enjoy of receding before a storm, the shingle being pushed by the percolating water,* and material scoured from the face being flung over to the back of the bank into still water, whence it does not return. The velocity of the tidal currents at the point continually increases as the spit lengthens. The flood-tide (coming from the quarter which brings waves) is, from this circumstance, much the more effective in moving shingle, hence the curvature increases near the end of the spit. The curvature of the stream-lines at the end of the spit has practically no effect during ebb-tide, for it is against the waves.

§ 8. On the Travel of Shingle across the Bays of the English Channel.

The velocity of tide currents in the bays of the English Channel† is in many cases insufficient to make shingle shift; but, as Sir George Stokes has shown,‡ the tidal current in co-operation with the long Atlantic swell is sufficient to move shingle at a depth even greater than is attained in these bays. Therefore, with such a swell running, the shingle in the bays will travel backwards and forwards with the tide; but during winds from the Atlantic, there is a flow of water through the English Channel from west to east,§ and the bottom current must be in this direction, for the wind blows from the salter to the fresher water. When the west wind subsides, an equal, or perhaps a smaller, quantity of water finds its way back down channel; but the waves have now subsided, the bottom water is therefore but slightly agitated in the deeper parts of the bays, and consequently the shingle does not travel westwards. The waves from the east in the English Channel are, it is generally allowed, of less amplitude than those from the west, and, which is of more importance, they are of much smaller wave-length. From such data as

* This action is very marked in the case of the Chesil beach, and (as has been pointed out to me) aids the encroachment of the Fleet upon the opposite shore.

† Consult, for instance, King's 'Pilots' Handbook for the English Channel,' 12th edition, revised by Commander T. A. Hull.

‡ *Trans. Devon. Assoc.*, vol. xix. pp. 512–515.

§ Compare Mr. H. N. Dickson's salinity maps in *Geographical Journal*, March, 1896.

I have, I reckon that they would move shingle at 10 fathoms, hardly at all at 20 fathoms, and probably not at 30 fathoms, which is about the greatest depth in these bays. But even at 10 fathoms, the movement of shingle must be little more than an oscillation with the tide, for there can be but little bottom drag in the direction of a wind blowing off the continent from fresher towards salter water. I conclude, therefore, that the shingle swept past the headlands of our south coast can work its way, in the course of the seasons, eastwards across the bays. When in this manner it is once more brought to shallow water, the sharper shoreward impulse of the swell which has "felt the bottom" jerks it in, until it once more reaches the breaker and is thrown upon the beach.

§ 9. On the Growth and Diminution of a Shingle Ness.

The coast-line recedes before the sea at any part (not suffering upheaval) where the removal of detritus (by littoral drift and off-shore movement) is not compensated by an equal or greater amount brought by the sea. The direct local supply of detritus, by waste of the coast, obviously cannot cause that part of the coast to advance. Shingle is chiefly derived from the waste of cliffs;* under cliffs of compact rock littoral drift is accelerated, and shingle beaches form to "leeward." At any part of a shingly shore *where supply exceeds loss* (*e.g.* on account of checking of current), *the beach grows seaward. This increases the total length of the shingly coast, and the supply of shingle per yard frontage therefore decreases, until it only just suffices to compensate the loss. The Ness has then reached its maximum growth* under the given conditions. Such growth may commence, for instance, when a wasting chalk hill slopes seawards, so that the height of the cliff and the supply of flints which feeds the beach are increasing. Conversely, the Ness may diminish when the receding hill which supplies it slopes landwards. Dungeness is supplied, not directly from the waste of cliffs, but indirectly through an intermediate deposit which encroaches, after the manner described under "Shingle Spits," upon the river Rother. The point of Dungeness tends, therefore, to preserve a constant bearing and distance from the extremity of this accumulation of shingle, and therefore, of necessity, a constant distance and bearing from the mouth of the Rother, the position of which is controlled by that of the shingle bank to the westward. An accumulation such as Dungeness is less subject to alternate growth and diminution than a Ness which is fed directly from a wasting cliff, for the annual supply depends upon the outgoings from the intermediate store-house for shingle. This is determined by the length of its sea-front, which is not appreciably affected by the removal of several layers of the shingle. Thus the fluctuations of the cliff-supply are diminished.

§ 10. The Grading of Beach Shingle.

(*a*) The Laws of the Grading of Beach Shingle.—No stony particle of less than a certain critical size can remain permanently on a beach, but is ultimately swept out to sea. This critical size is greater on a coarse-grained than on a fine-grained beach, for the *regimen* slope of the former is steeper, and gravity therefore gives greater assistance to the back-wash. It is well known that every particle upon the surface of a beach suffers attrition, whence the conclusion has been too hastily drawn that the grain of an isolated beach naturally becomes finer as the distance increases from the extremity where the beach is fed with detritus. Now, it is to be noted that *whereas the attrition of the particles tends to lower the average size of the shingle, and hence to make the grain of the beach finer, the removal of particles of less than the critical size raises the average dimension of the shingle.* Hence we may

* Except where mountain torrents rush straight to sea, as, *e.g.*, on the Riviera.

deduce the following *laws of grading of beach shingle applicable to a beach fed entirely at one extremity, whence the material travels along the beach*:—

Law 1. If the material be of uniform size, the grain of the beach becomes finer as we recede from the source of supply.

Law 2. If the material be mostly fine stuff, with a small admixture of coarse stuff, then (unless the coarse stuff be very friable, and the fine stuff very durable) the grain of the beach will become coarser as we recede from the source of supply, for the average size is more affected by the removal of a large number of fine grains than by the attrition of a small number of coarse grains. This increase in coarseness will continue until the beach material is brought to a uniform size, when the grading proceeds as in 1.

Law 3. If the material be mostly coarse stuff, with a small admixture of fine stuff, then, as we recede from the source of supply, the grain of the beach will become finer, for the attrition of a great number of large particles has a greater effect upon the average size of the material than the removal of a small number of fine particles.

By combining 2 and 3 we can deduce the following *corollaries applicable to a beach fed from both extremities*:—

Cor. i. If the material fed in at one extremity be mostly fine, and at the other mostly coarse, the grain of the beach increases in size from the former to the latter extremity, the two modes of grading co-operating.

Cor. ii. If the material fed in at both extremities be mostly fine, the grain of the beach will be coarser in the middle.

Cor. iii. If the material fed in at both extremities be mostly coarse, the grain of the beach will be finer in the middle.

Law 4. The grain of the beach is (*ceteris paribus*) coarser where the beach is exposed to the heaviest breakers. This law follows from what has been said on the action of the back-wash, and on a "critical size" of beach material. We may add to the italics of § 5 (*c*) that the *deeper* back-flowing stream *floats* out the smaller shingle.

Law 5. The grain of the beach is (*ceteris paribus*) coarser near the "weather" end of a promontory. Thus, if west be the weather side, and the end of a long beach be protected from the east by a headland at the eastern extremity, then both large and small pebbles will travel eastward along the beach in a westerly wind, but only the small ones are carried back from the promontory during an east wind, so that the proportion of large pebbles to small is increased as we near the promontory from the west. This is, in fact, similar to the case of the sorting of sand from shingle by unsymmetrical oscillation, as described in § 4.

Grading by Groynes.—When groynes are erected to check the drift of shingle, we find that the shingle is coarse where it is piled up near the seaward extremity or point of each groyne (A, A′, A″, Fig. 2), and relatively fine at the base of the groynes (B, B′, B″). This grading is effected as follows: At the points (A) the breakers beat most strongly, and from these positions the next step in advance can only be made by sweeping out shingle round the end of the groyne; thus, as we go from the A to the B positions, the *ratio* of the rate of removal of fine shingle to the rate of removal of coarse shingle increases, the proportion of coarse shingle present is therefore correspondingly increased at the A positions, and the grain of the beach at these positions is consequently large.

(*b*) On the Diffusibility of Shingle.—It appears that the grading of shingle and the phenomena of long-shore drift of shingle must of necessity be influenced by a peculiar process, which, from its physical analogies, I term a process of diffusion.

In virtue of the property termed "diffusibility," the particles of contiguous masses

of liquids or gas intermix somewhat slowly, not only without the assistance of external agency, but even against such agency, the process being termed "diffusion." If an aggregate of stones be exposed to an *absolutely steady current*, there is no motion of individual particles up-stream, but *when, as is usual on beaches, the main drift of the material is in the direction of the more potent of two alternating motions of water, there may be a true diffusion of shingle against the drift.* In order to fix our ideas, let us suppose that the main drift due to the motion of the water is eastwards. Now, since it is only the top layers of a beach which move, such shingle as happens at any time to be buried escapes transport until again uncovered. *Among an indefinitely large number of cases, it must happen that some pebbles driven westwards are always buried when the easterly drift succeeds, and are uncovered during the next westerly drift, and hence go westwards again, working their way against the main drift.* The chances are against any selected pebble working its way against the drift, and experiments with a moderate number of selected pebbles

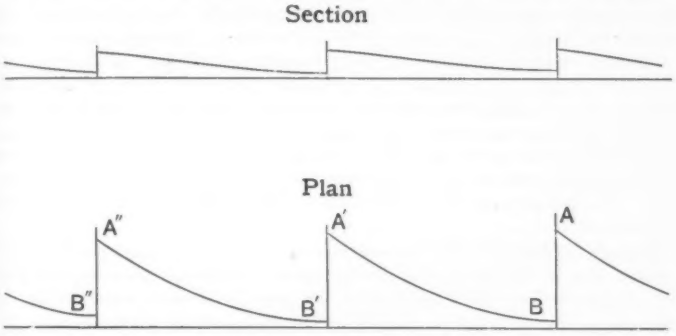


FIG. 2.—GRADING BY GROYNES.

ought therefore, as a rule, to yield negative results, but with the very large numbers of particles which are supplied naturally to a beach by denudation, some are sure to go against the drift. Now, the study of clastic aggregates such as beaches differs from that of gases or of liquids, in that the molecule or wandering individual of beaches *can* be perceived. Clerk Maxwell has pointed out that deductions from the statistical study of gases might not apply to the behaviour of those individual molecules which sharpened faculties would enable a man to study. Conversely, if we recognize one or two travelled pebbles of a conspicuous kind, we must not straightway conclude that the main drift of the shingle is from the direction whence these pebbles come. Due account must be taken of diffusibility.

(*c*) A BEACH SURVEY.—What is now wanted for the further study of grading and drift of shingle and sand, is a simultaneous survey of a complete coast-line, preferably the whole coast-line of Great Britain. The samples should be collected between the high tides of the same day, and should be taken just below the last high-water mark. If practicable, the survey should be made in duplicate at six months' interval. The Coastguard provides the requisite organization; the cost and trouble would be but small if the Admiralty give the order. In addition to serving the special purpose which I have indicated, the collection would be a permanent work of reference for the geologist and the civil engineer.

(*To be continued.*)

THE MONTHLY RECORD.

EUROPE.

The London Geological Field Class.—We have received from Prof. H. G. Seeley the syllabus for 1898 of the London Geological Field Class, which has now carried on its useful operations for twelve years, having been established in 1886. Its object is the teaching of physical geography in the presence of the geological structures on which that science is based, the instruction being given during Saturday afternoon excursions between the end of April and the middle of July. During the present season a variety of strata in the neighbourhood of London will be examined, and a study made of the relation of the surface features to the folding and mineral character of the strata, and to the denuding forces by which the surface has been shaped.

The Ports of the Sea of Azov.—The *Annalen der Hydrographie* (No. IX., 1897) contains a paper setting forth the latest information obtainable from official sources with reference to the ports of the Sea of Azov. The ports dealt with are five in number—Kertch, Genichesk, Eisk, Temrjuk, and Anapa. A short description is given of each, its position and population; and the nature and amount of its foreign and coasting trade, statistics being added for a number of years where possible. There are also descriptions of the harbours, the nature of the anchorage, the prevailing winds at different seasons, and the accommodation for loading and unloading vessels, with notice of improvements in progress or about to be undertaken. We commend the paper, short as it is, to those interested in the commerce of this region.

Travels in Spain.*—Dr. Gadow's volume supplies a pleasant proof that it is unnecessary to leave Europe to find subject-matter for an interesting book of travels, but that there still remain secluded spots not overrun with tourists, in which native life and character may be studied comparatively uncontaminated by contact with the outside world. It describes two extended journeys made by the author and his wife in Northern Spain, during the course of which many of the wilder districts of Galicia and other northern provinces were traversed, and many opportunities enjoyed of becoming acquainted with the unsophisticated life of the country districts, as well as that of the somewhat more civilized town-dwellers. To those who remember George Borrow's vivid descriptions of the wilds of Spain in the earlier part of the century, Dr. Gadow's pleasantly written narrative will be of special interest. In spite of the introduction of railways, and even of such appliances of civilization as the electric light, many of the towns appear to have little changed since Borrow's day, and in some cases even to have retrograded. Thus we are told of Pajares, formerly a prosperous place with a large traffic across the pass between Leon and the Asturias, that "all this has been changed for the worse by the railway, which to the villagers is of no use whatever." The most "dead-alive" of towns, however, such as Villafranca del Vierzo, have a wealth of historical associations, and notes on these are freely interspersed in the narrative and heighten its interest. Many fascinating pictures of natural scenes are drawn, and are brought vividly before the reader by the help of the many excellent illustrations.

ASIA.

Captain Deasy in Central Asia.—Captain Deasy writes from Yarkand

* 'In Northern Spain.' By Hans Gadow, M.A., PH.D., F.R.S. Map and Illustrations. London: A. & C. Black. 1897.

under date January 23, giving some details of his work during the past winter. He had reached Yarkand from the Taghdumbash Pamir *viâ* Raskam, Bazar Dara, Kulian Arik, making *en route* an important discovery with respect to the Yarkand river. Its true course proved to be different from that shown on the Society's map of the Pamirs published under Mr. Curzon's direction. The great bend of the river shown on that map was based on the work of Captain Grombchefski, the only traveller who had then visited that part of the country, but the greater part of its course was merely shown hypothetically. Younghusband, in the map accompanying his book, 'The Heart of a Continent,' omits the bend entirely. Captain Deasy hoped, as soon as the sick members of his party (including the sub-surveyor who accompanies him) should be well enough to travel, to ascend the Yarkand river southwards to near Raskam, and obtain more particulars as to the geography of this little-known region. He has already carried out a triangulation, during the course of which he had to camp close to the top of the Kukalung pass, about 16,500 feet above the sea, a few days before Christmas. He has also devoted much attention to astronomical observations, though much hampered by cloudy weather. He hopes to be joined in May by Lieut. Stotherd, and, if the journey is successful, will probably not return to civilization until next year.

Explorations in Indo-China.*—Of late years the details of French exploration in Indo-China have been but little known to English readers, and it is, therefore, matter for satisfaction that the account of one of the latest and most successful of the numerous French journeys in that region should have been presented to the British public by the recent translation of Prince Henri of Orléans' narrative. The journey of which it tells was remarkable, as piercing for the first time the "iron wall that separates British India from the Chinese frontier," as the excessively difficult country about the sources of the Irawadi was well termed by the late Sir H. Yule. Although some regret is unavoidable that this exploit—the accomplishment of which was the ardent desire, over a quarter of a century ago, of that daring explorer, Mr. T. T. Cooper—was not the work of a British traveller, it is impossible not to admire the dauntless spirit which carried Prince Henri and his companions through the many difficulties which beset their path, difficulties of which a vivid idea may be gathered from the Prince's pages. The country traversed presents a surpassing interest from the striking character of its physical features—its great rivers running in parallel courses between precipitous mountain walls, its trackless forests (tropical or coniferous according to altitude), its rushing streams liable to sudden floods—and we hear much of the dangers arising from slippery mountain paths, and the frail and quavering bridges to which the traveller must trust himself for the crossing of unfordable rivers. Of geographical results, the journey was decidedly fruitful. Apart from the elucidation of the problem of the Irawadi sources, much new light was thrown on the borderland of Tonkin and Yunnan between the Red river and Sumao, whilst the section of the Mekong explored had been previously almost unknown to Europeans, except at the crossing of the great Yunnan-Burma road. In this part the river bears a great variety of names, generally derived from the places at which crossings are effected. It is interesting to notice that one of D'Anville's names for this part of the stream—Kiu-lan Kiang—was found to be in use, as well as the more generally applied name Lan-tsang-Kiang (also given by D'Anville). The stream is throughout turbid, confined, and rapid, and is spanned at several points by chain bridges, though none exists between the

* 'From Tonkin to India.' By Prince Henri of Orléans. Translated by Hamley Bent, M.A. London: Methuen. 1898.

latitude of Tali-fu and Tsiamdo on the Pekin-Lhasa road. Some valuable information was likewise obtained with respect to the upper Salwen, which, near the latitude of Tali-fu, gave the impression of "a large river coming from afar." Its low-lying valley was found to bear the same reputation for unhealthiness as was noted by Captain Gill. It too bore a variety of names: that of Lu-kiang was said by the native interpreter, Joseph, to signify "Wrath river," and would thus appear not to be derived from the Lu-tse tribe, as is generally stated. In fact, the Lu-tse of one section of the river are said to be called so from the fact of their living on the river, and not *vice versâ*. The name Nong-kiang recalls the A-nong of the Abbé Desgodins, said by him to be the true name of the Lu-tse. Of special interest is the information with regard to this and other aboriginal tribes, who in a limited degree own the supremacy of the Chinese, and who hardly bore out the reputation for ferocity given them by their neighbours. Though the men were dirty and repulsive, the women were often much more pleasing. Prince Henri speaks in high terms of the work of his compatriots of the Tibet mission, one of whom had, during twenty-eight years, seen only one other traveller—Cooper. The book is provided with a large number of illustrations, but many of these are evidently rather fanciful. The French spelling of place-names—which is not only clumsy at times, but actually misleading to English readers—has unfortunately been retained both in the text and the map. Thus we find Lbaça, Choueli, for Lhasa, Shweli. Some useful geographical appendices by M. Roux complete the volume.

The Persian Gulf.—We have received from the author a copy of an inaugural dissertation by Herr Siegfried Genthe on the Persian gulf. The first part of the paper is occupied with a discussion of the commercial history of the gulf in relation to its geographical position; a fairly comprehensive summary is given of the most important works on the subject, oriental and otherwise, and there is some rather futile speculation as to the *rôle* of the Persian gulf in a future overland route to India. The second half is devoted to the physical geography of the region. A new map, based almost entirely on the Admiralty charts, shows the contour lines, and an attempt is made to estimate the rate of formation of the delta of the Shat-el-Arab by comparison with Dalrymple's charts of date 1786. Planimetric measurements of the new map give smaller results, both for surface area and mean depth, than those usually accepted. Herr Genthe admits, however, that the scientific exploration of the region is not sufficiently advanced to allow of satisfactory conclusions being drawn. We entirely agree with him that it is one of great hydrographical and geological interest, well worthy of a careful survey like that carried out by the *Pola* in the Red sea.

The Southern Chin Hills.—A lately issued report by Captain G. C. Rigby (Rangoon, 1897), on the military operations carried out in 1896–97 in the little-known hilly districts on the frontier between the Northern Arakan hill tracts and the Pakokku district in Upper Burma, contains some valuable information with respect to the general nature of the country and its inhabitants. These operations, in which Captain Rigby took part as intelligence officer, were rendered necessary by the raids committed by some of the Chin tribes on certain villages and posts on the Burmese side, and during their course advantage was taken of the opportunity afforded to survey and generally obtain a more accurate knowledge of the country traversed. The backbone of the whole region is the Arakan Yoma range (6000 to 7000 feet), which divides the streams flowing westwards to the Gulf of Akyab and eastwards to the Irawadi. West of it is a series of dense jungle-covered ranges running north and south, drained by the Lemru and Kaladan rivers. To the east an important spur branches off in a south-east direction,

known as the Kunumchung range. It is higher than the main range, and culminates in Mount Victoria (10,090 feet), the highest peak in Burma. Between it and the Yoma range flows the Mon river, which, after a course of 160 miles, joins the Irawadi a little north of Minbu. Its course within the Chin hills is not shown at all on most of our maps. Long spurs run eastward from the Mount Victoria range, making travelling exceedingly difficult from north to south, but comparatively easy from east to west. Most of the tracks possible for mules (roads exist only on the eastern edge of the district) follow the crests of these ridges. Towards Arakan, on the contrary, communication is easier in a north and south direction. The climate is cold and bracing in the higher parts; the rainfall is apparently of a drizzly nature, as there are no signs of a heavy flood rise in the larger streams. Economically, the country is described as worthless, and food-supplies are very limited. Millets form the staple crop. The main Yoma range is densely jungle covered, principally with oaks of various kinds, and rhododendrons are also met with. To the west the hills are covered with dense thickets of small bamboo. Elephants and rhinoceros have now disappeared to the east of the watershed, but black bear, bison, sambhur, barking deer, etc., occur in large numbers. Several sites suitable for sanitaria are mentioned by Captain Rigby, and he bears witness to the great natural advantages of the Mount Victoria range, the air being most exhilarating. In addition to minute topographical details, illustrated by route and other maps and sketches, the report contains notes on the various sections of the Chins. Their villages are nearly always built on the steep hillsides, the houses being placed one above the other on platforms dug out of the hill. One section of the Chins is known as that of the "Cane-bellies," from the coils of split cane which they wear round the waist.* They are a superior race, of fine physique, and proved friendly and honest.

Journeys in China and Manchuria.—Prof. L. v. Lóczy has sent to *Petermanns Mitteilungen* (March) a note on the journeys so far made by Dr. Eugen v. Cholnoky, Assistant in Geography at the University of Budapest. Starting from Shanghai in February, 1897, the explorer traversed the network of canals to the south-east of the Tai-hu till he reached the sea-dyke on Hangchau bay, which he then followed to Hang-chau, passing Tsa-pu and Hai-ning-hsien. At the last-mentioned place he made careful observations of the bore of the Tsien-tang, and photographed this phenomenon in its various phases. Various other journeys were made on the southern borders of the great plain and on the lower Yangtse-kiang, the distribution of laterite and alluvial deposits being special subjects of investigation. In May and June he made an excursion in Northern China and Mongolia (by Kalgan and Lama-miao), during which he made observations on the subaërial and alluvial deposits of that region, and then, acting on behalf of a French mining syndicate, he betook himself in August to Nagasaki, and thence to Vladivostok and Possiet bay, in order to reach the mining colony of Tien-pau-shan by way of Hunchun. Having completed his examination of those mines, he spent the period from October to December in traversing Southern Manchuria by way of Womosu, Kirin (Girin), and Mukden, finally arriving at Shanhaikwan, the terminal station of the Chinese railway. A continuous route-map on the scale of 1:100,000, several astronomical observations for latitude, and an insight into the geotectonic structure of the region traversed, are the results of this journey. His astronomical observations appear to show that Hunchun and the northernmost point of Korea are half a league further south than now shown on maps. A large number of

* This remarkable girdle appears to be similar to that shown in photographs of the Andamanese, and also to that recently noticed among the aborigines of Formosa (*ante*, p. 68).

volcanic cones and an extensive lava-field were observed on the journey from Hunchun to Kirin.

AFRICA.

Surveys by Major Macdonald's Expedition.—In a letter written from Banda, 10 miles south of Lake Ibrahim, on February 2 of the present year, Major Macdonald informs us that, although his expedition has been diverted from its intended course by the Sudanese mutiny in Uganda, a certain amount of geographical work has been accomplished by various members of his party. Thus Lieut. Hobart has filled in some of the blanks in our maps in the east of Ankole, where he has discovered a lake some 12 miles by 3. During the pursuit of Mwanga's army, Captain Kirkpatrick did some work to the north-west of Koki, discovering another lake. Major Macdonald himself has added to our knowledge of the little-known country north of Chagwe and east of Bulamwezi. Captain Austin, during his march from Baringo to Save, north of Mount Elgon, was enabled to correct mistakes in older maps, besides adding fresh information. It appears that the crater of Mount Elgon is further north than was formerly supposed, Mr. Hobley's position being about right. Lieut. Hanbury Tracey, too, has explored the country for some distance north of the mountain. Major Macdonald remarks that the Luajali and Lake Ibrahim are shown on the old maps some 8 or 10 miles too far east, and that the shifting of their position involved by his recent work harmonizes with that brought about by the railway survey in respect of the Ripon falls, and by Lieut. Vandeleur's observations in respect of Foweira.

Hydrography of the Upper Nile Region.—M. E. de Martonne, whose studies of the social and political condition of the tribes of the upper Nile region have already been referred to in our pages (*Journal*, vol. x. p. 95), supplies a useful summary of our present knowledge of the hydrography of that region in the *Zeitschrift* of the Berlin Geographical Society (1897, No. 5). It, of course, does not present any new information, but full use has been made of the voluminous literature of the subject, and copious references to authorities are given throughout, while the facts are presented concisely and clearly. The paper is accompanied by maps and sections, the former showing (1) the oro-hydrographical features of the region, (2) its rainfall. In the first map, the contours of altitude are shown, six gradations of tint being employed, while the nature of the various streams—their permanence or temporary character, the swampy portions of their courses, and the position of the falls and rapids which impede navigation—is shown by a distinctive method of delineation. The limits of the upper Nile basin—a subject to which special attention is devoted in the text—are shown by a continuous line where accurately known, by a dotted line where more or less hypothetical; and the large use made of the latter, especially in the central basin of the river, shows clearly how much remains to be done before the complete system of the Nile can be said to be fully known. Not only in the direction of the Shari basin and of Lake Rudolf,* but even in Kordofan and the region between the Blue and White Niles, the exact limits of the basin are still undefined. The diagrams include profiles of the upper Nile region from south to north, and from west to east, and of the course of the Nile itself from its headwaters to Fashoda; also a graphic representation of the distribution of rainfall through the year. The rainfall map, though it cannot, of course, lay claim to minute accuracy, is based on all the available material, a summary of which is given in a table embodying the results at thirty-six different places.

Tunis since the French Protectorate.—An exhaustive report on the present

* The data for the map are brought down to July, 1897, so that account has not been taken of the results of Captain Bòttego's last expedition, which had not then been published.

condition of the Regency of Tunis, and the progress it has made since the establishment of the French Protectorate, has been made to the Foreign Office by Sir Harry Johnston, now British Consul-General in that country. It contains a large amount of valuable information on the government and administration of Tunis, its commerce and resources, its system of communication, and so forth, as well as details useful to the tourist, and a discussion of the prospects of British trade with the Regency under the new customs tariff. Having visited the country in 1880, before the French occupation, Sir Harry Johnston is well qualified to speak of the results attained after seventeen years of settled government; and the comparison he draws between the dangers incurred by European travellers at the time of his first visit, and the present security both of life and property, is a striking testimony to the benefits which have been brought to the country by French rule. Improvements are to be noted in all directions. Roads and railways have been constructed; the ruthless destruction of forests has been stopped; wells have been sunk, manufactures encouraged, and useful public works set on foot. Of the numerous agricultural resources possessed by Tunis, the olive tree promises, Sir H. Johnston thinks, to become its most important asset in the future. The export of *halfa*, or esparto grass, has recently much diminished; but the demand for it will probably go up, now that it has been shown that paper made of wood-pulp crumbles to pieces after a few years. The fisheries are of singular wealth, and the live stock includes horses, mules, donkeys, camels, oxen, sheep, and goats. Tunis is, in Sir H. Johnston's opinion, as certain to become a white man's country as is Cape Colony. Rome, through her daughter France, will resume her sway, and the damage done by the Mohammedan invasion of the seventh century will be repaired. As regards British trade, the total value of which for 1897 Sir H. Johnston puts at £680,000, we had, he thinks, little reason but to be satisfied with the results of French protection down to the end of that year, and even under the differential treatment now accorded to French commerce, a considerable future may be anticipated for British trade. The demand for British cotton goods shows a tendency to increase, and those already sent seem to meet the local taste exactly. But here, as elsewhere, in spite of the excellence of our goods, they are in many cases losing their hold on the people, through the little effort made to push them.

Uhehe as a Field for German Colonization.—The attention of those interested in the future of German East Africa has of late been increasingly turned to Uhehe as a possible field for *Colonization* by Europeans as distinguished from the mere establishment of plantations under European control. From various quarters come testimonies to the suitability of the region for that purpose. We have already referred (*Journal*, vol. x. p. 638) to a paper by Herr von Bruchhausen on the Uchungwe mountains in Uhehe as a field for colonization, and this is now followed by an article in *Globus* (1898, No. 3) by Count von Pfeil, on a somewhat broader aspect of the question. He points out that on his first visit to Uhehe, in 1886, he was much struck with the fact that it was, to use Mr. Rhodes' expression, "a white man's country," and comparable to the Orange Free State in South Africa. At that time, however, the general attention was so taken up with plantation projects in Usambara and elsewhere, that his ideas attracted little notice. He is now able to point with satisfaction to the similar views lately expressed by Lieut.-Colonel Liebert, and he devotes his article to an examination of the grounds on which this opinion is based. Having shown that the country contains a sufficient area of an average elevation of 6000 feet to offer an independent means of livelihood to a considerable number of settlers, and to secure the future of the whole German sphere, he inquires whether the physical conditions of the country are such as permit prolonged residence for Europeans without detriment to health.

This leads him to a comprehensive sketch of the climate and soil of the district, its natural productions, etc., and the result is to show that an experiment in colonization is decidedly to be recommended. Count von Pfeil draws an attractive picture of the country, in which existence is a delight, and which he never could leave without regret. The illustrations, from his own sketches, which accompany the paper, fully bear out his description of the romantic scenery of Uhehe. In two papers printed in Nos. 6 and 11 of the *Deutsche Kolonialzeitung* for the present year, Dr. Arning takes a similar view as to the capabilities of Uhehe. The conditions there are, he considers, so favourable, that the settlement of the country might form a turning-point in the development of German East Africa. It is unfortunate that this favoured country should, according to recent reports, have been the scene of a serious rising against the German authorities.

Proposed African Expeditions.—An important Belgian expedition has just started to complete the scientific exploration of the southern parts of the Congo basin. Its leader is Lieut. Lemaire, who is accompanied by five Europeans. The expedition will start from the east coast, and reach Lake Mweru by the Nyasa route, continuing its route westwards to the Kasai and lower Congo. It is also announced (*Petermanns Mitteilungen*, No. 2) that Dr. Holub, the well-known South African explorer, is to return once more to the scene of his labours. He does not propose, however, to start until next year.

Journey to Lake Rukwa.—In connection with the report of Captain Langheld (*ante*, p. 68), that Lake Rukwa has almost entirely dried up within the last few years, the account of a journey lately made to the southern shore of the lake by Governor von Elpons (*Deutsches Kolonialblatt*, February 15) is of interest. Starting from Mirambo, on the Songwe, towards the end of September last, Herr von Elpons passed through the districts of Buntali, Unyika, Inyamwanga, and Wuanda, and along the Saisi to the village of Samangombe, on the lake-shore. Here there was hardly any water in the Saisi, while the lake was not visible, the country consisting of a vast dry grassy plain, abounding in antelopes and zebras. The lake was apparently reached a little to the east of the Saisi, but the water, as already reported by Mr. Nutt in 1894 (*Journal*, vol. vii. p. 427), was extremely shallow near the south shore. The area occupied by the water is not stated, so that it does not appear whether it was more or less extensive than at the time of Captain Langheld's visit. The districts passed through on the way to the lake were mostly well peopled, and their inhabitants friendly. Buntali is said to be astonishingly fertile, and its elevated position and protection by ranges of hills from the fever-bringing winds give it a great advantage over Konde. In many parts the people showed themselves ready to go as labourers to the German stations. Jumba-Wuanda, the chief place of the district of Wanda, showed evidences of considerable trade activity, though due perhaps in part only to transit trade to Uwemba. Muniwungu, at the south-east end of the lake, visited by Johnston in 1889, is also said to do a considerable trade with the coast. Herr von Elpons does not think favourably of the prospects of training the zebra as a riding animal, the possibility of which has lately been discussed in the German colonial press.

The Headstreams of the Kagera.—Besides the journeys of Captain Ramsay already referred to (*ante*, p. 299), those of Colonel von Trotha, of which a short account has lately been published, have thrown some light on the little-known region at the sources of the Kagera. According to a note in *Petermanns Mitteilungen* (1898, No. 2), Colonel von Trotha is inclined to consider the Nyavarongo as the principal headstream of the river. He also considers that, according to the agreement of 1884, the whole of the basin of Lake Kivu and the Rusizi properly falls to Germany, and that the Congo State has occupied this district without a

legitimate title. Colonel von Trotha's journey, during which he paid particular attention to the topography of the country passed through, was carried out in 1896 and 1897. The earlier part of it has already been referred to in the *Journal* (vol. ix. p. 90). We learn from the *Mouvement Géographique* (1898, No. 3) that a private German expedition under Dr. Kandt set out in June last to complete the exploration of Urundi and Ruanda.

Captain von Carnap's Journey from the Cameroons to the Congo.—We have already alluded (*Journal*, vol. x. p. 638) to the exploration in the interior of the Cameroons undertaken by Captain von Carnap. We now learn from the *Mouvement Géographique* (Nos. 12, 13) that that officer has brought his journey to a successful conclusion, reaching the Lower Congo by way of the Sanga, and thus for the first time effecting a direct communication by land between the Cameroons and the Congo. Starting in September last from the Yaunde station, with a caravan of 200 men and one European companion, Captain von Carnap set out in an easterly direction towards the waterparting which separates the upper branches of the Nyong from the affluents of the Goko, one of the principal branches of the Sanga. The passage of this line of high ground offered no serious difficulties, though the considerable altitude attained caused the porters to suffer much from cold. Meeting with resistance on the part of the natives, who had never before seen a white man, the expedition deviated towards the north, reaching the town of Kunde, just within French territory. After obtaining permission from the French authorities to proceed with his armed force through the French sphere, Captain von Carnap made his way to Carnotville, and thence down the Sanga to the Congo, reaching Matadi by railway on February 11. According to a note by Herr Staudinger in the *Deutsche Kolonialzeitung* for March 31, Captain von Carnap found a Dutch firm already established for purposes of trade in the south-east corner of the Cameroons territory. Herr Staudinger urges the need of the opening up, by the German authorities, of this corner of their sphere, pointing out the value of Captain von Carnap's journey in this direction.

The Population of the Congo Basin.—In No. 8 of the *Mouvement Géographique* for the current year, M. Wauters recurs to the subject of the density and distribution of population in the Congo basin, a subject which has previously been dealt with from time to time in that journal. After noticing some of the estimates hitherto made of the total population of the Congo basin, from the 28 millions of Stanley to the 11 millions of Dr. Vierkandt (*Journal*, vol. vi. p. 183), M. Wauters calls attention to the great differences as regards density which exist between various parts of the basin, and shows how difficult it is, in the present state of our knowledge, to come to any accurate conclusion on the subject. He considers that the facts noticed on the river-banks, which form the best-known part of the basin, probably give an inadequate idea of the general density, the riverine villages being often mere dependencies of the large interior centres. M. Wauters quotes data from various travellers, showing how great is the population in certain districts, and comes to the conclusion that Dr. Vierkandt's estimate is far too low. That of Stanley, which gives a mean of twelve inhabitants to the square kilometre (between four and five to the square mile), is probably not far from the truth.

Completion of the Congo Railway.—After eight years of arduous labour, the great work of uniting the navigable portions of the upper and lower Congo by means of a railway has at length been virtually completed. A despatch was received in Brussels on March 27, announcing the arrival of the first locomotive at Dolo, on Stanley Pool. The Belgian company which has carried the undertaking through to this successful issue is to be congratulated on the achievement of a

work which is likely to have so important an influence on the opening up of Central Africa. The *Mouvement Géographique* devotes its fourteenth number to a succinct review of the history of the undertaking, showing by a striking diagram the network of navigable waterways by it thrown open to the trade of the world.

The Ambaca Railway in Angola.—The fifth number of the *Mouvement Géographique* for the current year contains some extracts from the report of the company which is constructing the Ambaca railway, showing the progress made with the works, and the receipts during each year since traffic was inaugurated. Progress during 1896–97 had been slower than had been hoped, owing to sickness among the workmen and the difficulties encountered in the construction of the important viaducts between the 309th and 316th kilometres (192 and 196 miles). It was hoped, however, that locomotives would reach the terminus of the first section of the line (Lucalla) in August, 1898, there remaining only 35 miles to complete. The gross receipts of the line per kilometre open rose steadily from $234 in 1890–91 to $691 in 1896–97, but the increase during the last year was comparatively small, owing to depression of trade. A contract was signed in 1897 for the extension of the line as far as Malanje.

AMERICA.

Submerged Valleys off the West Coast of North America.—The *Proceedings* of the California Academy of Sciences contains an important paper by Dr. George Davidson on the submerged valleys off the coast of California, U.S.A., and of Lower California, Mexico. The first of these valleys, now known as the Hueneme valley, was discovered by the U.S. Coast Survey in 1855, and others have come to light from time to time in the course of surveys required for navigation. All those at present known lie south of Cape Mendocino, when the coast ranges from the south and south-east seem to end abruptly on the ocean front. Dr. Davidson has given attention to the subject for a number of years, and his paper is a condensed description, illustrated by nine plates of carefully drawn contour charts, of all the submerged valleys which have been surveyed up to the present. It would serve no useful purpose to attempt to summarize the contents; we need only draw attention to what is a valuable contribution to the literature of physical geography, as well as of navigation and of submarine telegraphy.

The True Route of Coronado's March.—This subject has been discussed by Mr. F. S. Dellenbaugh in a paper read before the American Geographical Society, and printed in the *Bulletin* for December, 1897 (also as separate pamphlet). The paper was originally read before the appearance of Mr. Winship's work, lately noticed in our pages (*ante*, p. 71), but before publication it has been to some extent revised in the light of Castañeda's text printed by Mr. Winship. The author considers that previous commentators have gone wrong in the determination of Coronado's route through not accepting Castañeda's statement that the expedition, after leaving Culiacan, the last European outpost, "kept the north on the left hand"—in other words, that the route was east of north. Owing to the difficulty in laying down the route in a north-easterly direction from the modern town of Culiacan, the course, as hitherto traced, has followed the coast for a long distance north-west before turning north, even then trending rather to the west than to the east of that quarter. Mr. Dellenbaugh evades the difficulty by supposing that the Culiacan of Coronado's time—a mere outpost—was not on the site of the modern San Miguel de Culiacan, but further up the coast near its intersection by the 109th meridian, where is a small town now called San Miguel. Tracing the route in a north-north-east direction from this point, he is able to offer very plausible identifications of most of the points touched at, especially Chichilticale, where, according to Castañeda,

the country ceased to be covered with spiney trees and changed its aspect, the mountains ceasing and the desert beginning. This description would exactly apply to the neighbourhood of Cuesta Grande, near the pass of Canetas in the Sierra Madre, as described by Mr. Bandelier. Mr. Dellenbaugh does not bring the expedition at all to Zuni, supposed to be the site of "Cibola," but considers that a position near the Florida mountains, quite in the south of New Mexico, agrees better with the statements of the chroniclers, and especially with the length of time taken by Cárdenas on his march to the cañon of the Colorado, and with the apparent position of Cibola relatively to the Rio Grande (river of Tiguex). On the positions thus assigned to the chief pueblos visited, Mr. Dellenbaugh bases his determination of the further route across the Buffalo plains, taking the expedition to the Arkansas near its junction with the Canadian river, and possibly beyond. His theory has this in its favour, that it enables him to keep strictly to the statements of the chroniclers; its weak point is the assumption with regard to the starting-point, on which the whole elucidation rests, each separate identification depending more or less on those that have preceded it.

The Mexican Snow-peaks.—The eighteenth publication of the Field Columbian Museum (Geological Series, vol. i. No. 2) consists of observations by Dr. O. C. Farrington on Mounts Popocatepetl and Ixtaccihuatl, from a geographical and geological point of view. Although much has been already written on the subject, Dr. Farrington's paper is of value, both as embodying the personal observations of a professed geologist on many debatable points respecting the physical features of the mountains, and as supplying a concise summary of our knowledge as derived from the work of previous observers. It is provided with excellent photographic illustrations, which enable the features of the peaks to be clearly comprehended. The writer's visit was made in February, 1896, Popocatepetl being ascended to its summit, whilst on Ixtaccihuatl the point aimed at was the glacier which descends the western side of the mountain to the level of 14,500 feet. During the ascent of the former, which was made from the north by way of the ranch of Tlamacas (about 12,800 feet), the symptoms of mountain sickness were felt to a considerable degree, especially during the first hour or two after passing the ranch. It being the dry season, the snow-line was not encountered until several hundred feet above the point known as La Cruz (14,100 feet), whereas in the wet season the snow and ice descend nearly to the ranch of Tlamacas. The depth of the snow was rarely more than a few feet—a fact to be accounted for, according to Dr. Farrington, by the regular slope of the cone and the permeability and dark colour of the underlying ash-bed, which melts the snow and constantly drains away the water. There is no accumulation sufficient to form a glacier, nor is anything like a crevasse to be seen. On the eastern and southern slopes the snow sometimes disappears entirely, the cause assigned being the warm air rising from the valleys of Puebla and Cuautla, and not, as suggested by Heilprin (*Journal*, vol. ix. p. 100), the warm vapours which flow from the lip of the crater. A graphic description of the latter is given, and the nature of its wall is well shown by a photograph, the layers of lava of which the cone is made up being plainly visible. Fumes were escaping by six vents at the time of the visit, but the number and position of these seem to be variable. Although less known, Ixtaccihuatl, in Dr. Farrington's opinion, far surpasses its companion from a scenic point of view, its sharp rugged outlines, precipitous escarpments, and deep narrow valleys giving it a wild and imposing appearance. As regards its height, about which much difference of opinion prevails, the writer is inclined to accept, as more nearly correct, the higher estimate (fully 17,000 feet). He is also inclined to agree with Mr. Howarth (*Journal*, vol. iii. p. 140), that the mountain is not, strictly speaking, a volcano,

whilst, unlike some observers, he considers the flora much richer than that of Popocatepetl. His investigations led him to conclude that at least one true glacier (that of Porfirio Diaz) exists on the western slope of the mountain, and that this had formerly a much greater extent than now. A full description is given, illustrated by several views of the glacier itself and its old moraines.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Harvard Geographical Models.—In a recent volume of the *Proceedings* of the Boston Society of Natural History, Prof. W. M. Davis explains the series of geographical models designed by him for use in his classes and geographical laboratory in Harvard University. He points out that the larger the scale of relief models of portions of the Earth's surface, the smaller is the necessary vertical exaggeration, and the more useful the model as an illustration of geographical forms. The models photographed in the paper are of the same type as Prof. Heim's, *i.e.* devoted to the delineation of typical geographical forms, not places which actually exist. They were modelled in wax, the fine detail being produced afterwards by carving-tools, and ultimately cast in plaster. In some cases the plaster models are further worked upon to produce new types. The models measure 24 by 18 inches horizontally, and their greatest elevation is about 2 inches above their sea-level. They may be taken as on the true scale of 1 inch to the mile. Every detail of form is copied from large-scale maps and photographs, and while some are unusual, none are impossible in nature. The first model figured represents a mountainous district bordering the sea, showing the effects of atmospheric, glacial, river, and sea erosion in its different parts, and bringing out clearly the contrast between submarine and subaërial contours. The model is used in teaching, in order to show how population would be distributed in such a region, where the towns and villages would lie, and how the roads would run; while the geological conditions that allowed of the particular forms being produced may also be discussed. The second model shows a region where the hills descend to a smooth coastal plain, sloping gently to the sea; the whole being of such a kind as might have been produced by the gentle uplift of the first model and the ordinary slow process of land-waste. The contrast of the hilly old-land in the background, and the new-land of the plain, seamed by its shallow river-valleys, is very clearly brought out, and can be discussed in its geological and in its anthropogeographical bearings as for the first model, the different conditions leading to a quite different distribution of population. The third model shows a mountainous region descending directly into the sea, with an irregular and highly developed coast-line of fiords and headlands. The whole represents conditions which could have been derived from the first model, if instead of uplift there had occurred subsidence admitting the sea into the mountain valleys. The beautiful photographs of the reliefs enables the reader to follow Professor Davis' most instructive geographical discussion of the models, and to realize what a vast aid the models themselves must render to the intelligent teacher who works out the principles laid down to their logical results. It is possible, in this way, to see how the forms of the land produced by the action of climatic agents on geological structures are in themselves determining causes of human development, and how some slight change in the forms of a country may account for a large final difference in the national interests of neighbouring peoples.

Age-terms for the Geographical Description of Land-surfaces.—Prof. W. M. Davis has a short note in *Science* (February 11, 1898) on the use of age-terms suggestive of systematic changes in the form of the land with the passage of time. He points out that such terms as young, mature, and old, have been very generally used to describe the stages reached in the development of a land-surface, but not always consistently. For instance, the well-dissected hills of Wisconsin

have had the term "topographic old age" applied to them, while on the other hand the equally thoroughly dissected Alps have been termed young. Both of these should, according to Prof. Davis, be termed mature, the epithets "young" and "old" being reserved for such forms as the moderately denuded Jura and for plains of complete denudation respectively. With the help of qualifying adverbs, the three terms should, he thinks, be sufficient at least for elementary descriptions.

GENERAL.

The Russian Geographical Society.—At the annual meeting, which took place on February 2, the yearly report was read. It appears that the Society has 1104 members: 18 of the imperial family, 24 honorary members (6 foreign), 23 members who have made larger gifts to the Society, 833 active members, and 206 contributor-members, as also 209 correspondents. The total yearly expenditure amounted to £2500. The Society has sustained many heavy losses, among others, Lieutenant-general I. S. Stebnitsky, who was chief of the cartographic work in Caucasia, and belonged to the Society for 37 years; State Secretary Groth, who was for years treasurer to the Society, and shortly before his death had given the Society £500 for investigating whether the island of Sakhalin is really suitable for colonization; Th. S. Sludsky, one of the best authorities in higher geodesy; the two great historians, Bestuzheff-Ryumin and Th. Buslaeff; Count Delyanoff, and many others. In view of the extraordinary importance of Nansen's discoveries, the Society departed from its fifty years' practice of awarding its Constantine medal to Russian explorers only, and awarded a special medal of this name to Dr. Nansen. The usual Constantine medal was awarded to V. I. Roborovsky, chief of the Tibet expedition, for his explorations of Central Asia. Count Lütke's medal was awarded to I. I. Strelbitzky, for his journeys in Persia and Manchuria; and the Semenoff medal, newly established in commemoration of his twenty-five years' presidency of the Society, to Sven Hedin for his three years' explorations in Central Asia. The great gold medal of the Society was awarded to I. N. Zhdanoff for his various ethnographical researches, and especially for his work, 'The Russian Epic Poetry'; and small gold medals to Th. Th. Witram, for his pendulum measurements in the Far East; to F. F. Sperck, for a large work, 'The Climate of the Astrakhan Region'; to S. G. Rybakoff, for his collection of musical texts of songs amongst the natives of the Ural plains; and to S. O. Gulishambaroff for his large work, 'The World's Trade in the Nineteenth Century, and Russia's part in it.' A number of silver medals were awarded, namely, to A. V. Pastukhoff, for his communication on the ascension of the Elbruz; to G. Th. Abels, for hypsometrical measurements in the Urals; to B. A. Fedchenko, for his journey in the Talas Alatau; to V. E. Timonoff, for his paper on the water-communications in the Amur region; to V. V. Sapozhnikoff, for his communications on the glaciers of the Altai; to A. M. Kovanko and V. A. Semkovskiy, for the part they took in the organization of the international simultaneous balloon ascensions in 1894, in which the Society participated, and the ascensions of the exploring unmounted balloons; to Lieutenants Prince Obolensky, Tomilovskiy, and Utyesheff, for the daily observations they made for the Society on the velocity and direction of movements of the clouds during the year 1896-97, when these observations were made internationally. Three bronze medals were awarded for services rendered by different persons to the Society's expeditions. The secretary announced that, January 29 having been the twenty-fifth anniversary of P. P. Semenoff's first election as Vice-President of the Society—a position which he still occupies—the Council of the Society has established a gold medal in his name, and has obtained from the Government the permission to open all over Russia a subscription for that purpose. A briliant ovation was made to V. I. Roborovsky.

OBITUARY.

Colonel Henry C. B. Tanner, Indian Staff Corps.

By Colonel Sir Henry R. Thuillier, K.C.I.E.

Colonel H. C. B. Tanner, of the Indian Staff Corps, and late of the Indian Survey Department, died at Bath on March 16 from pneumonia, after a brief illness of three days. The son of William Tanner, Esq., of Lockeridge, Wiltshire, one of the earliest colonists in Western Australia, Henry Tanner was born in Van Diemen's Land in June, 1835, and came to England when he was about nine years old. He was educated for the army, and obtained his commission from Addiscombe College in the Bombay Artillery in 1854, and went to India towards the end of that year. As a subaltern in a light field battery, he accompanied the Persian Expeditionary Force of 1856–57, and was present at the landing at Halila bay, at the taking of the forts of Reshire and Bushire, and in the action of Kushab, for which services he received the medal with clasp. After serving with a field battery for a few years, Lieut. Tanner obtained his "jacket," and was the *beau ideal* of a horse-artillery officer.

In October, 1862, he was transferred to the Bombay Staff Corps and appointed to the Survey of India Department, in which he remained during the rest of his career in India. He was first employed on various revenue surveys in Sind and in the Central Provinces, and was promoted to be captain in 1866. In 1871–72 Captain Tanner served as survey officer with the Lushai expedition, and accompanied Sir Charles Brownlow's column. He was mentioned in despatches, and received the thanks of the Government of India for his services therewith, and obtained a clasp. On return from the Lushai expedition, he was placed in charge of the topographical party employed in the western Ghâts of the Bombay Presidency; and from that time onwards his duties were connected with topographical surveying and exploring, for which his skill in drawing and delineating ground specially fitted him. In 1874 he was promoted to the rank of major.

On the outbreak of the Afghan war in November, 1878, Major Tanner was attached as survey officer to the Khyber column under Sir Samuel Browne, which advanced from Jamrud on Ali Masjid at the commencement of the campaign. He carried a continuous route-survey from Ali Masjid to Jalalabad and thence to Gandamak, reconnoitring the ground on each side as far as was practicable. He also measured base-lines and executed triangulations, combined with astronomical determinations of latitude and azmuth, at Dakka and Jalalabad. He took a number of observations to the peaks of the surrounding hill ranges both north and south of the Kabul rivers, and soon discovered, fortunately, that several of his points were identical with points which had been fixed several years before by survey officers in the course of the operations of the Great Trigonometrical Survey on the trans-Indus frontier. Thus these points became a basis for the survey operations, enabling them to rest everywhere on triangulations, and be made independent of further astronomical observations. Tanner subsequently took part in the expedition to the Laghman valley; and in May, 1879, having made the acquaintance of a native chieftain, the head of an important district lying between Jalalabad and the southern frontier of Kafiristan, he undertook with his aid an exploration into Kafiristan through the Kunar valley and Chuganistan. After several perilous adventures, he got into one of the Kafir villages, but there, owing to the hardships and exposure incident to such an undertaking, his health failed, and, prostrated by fever, he was compelled to abandon his design, and, disguised as a native, he was

carried back to Jalalabad under great risk through the hostile tribes by the friendly aid of the Chugani chief. For his services in the Afghan campaign, Major Tanner received the medal with clasp and the brevet rank of lieut.-colonel.

On the conclusion of the campaign in July, 1879, Colonel Tanner was sent up to Gilgit with the idea that he might be able to proceed thence to Kafiristan by a more easy and accessible route through Chitral, and also with the view of extending the operations of the Kashmir survey into Gilgit, which country could not be entered at the time the Kashmir survey was carried out some twenty years previously, owing to the hostile attitude of the people. At this time, however, the Gilgit country had quieted down, and a British officer resided at Gilgit as British agent on the frontier. Thus Tanner was able to proceed there without difficulty and commence making a survey of the country, getting to the peaks beyond, and fixing as much as he could see of the great ranges to the north. In 1881 he had completed field work, and was returning to headquarters to bring up his mapping, and had arrived at Lahore, when information was received that the tribes round Gilgit had broken into revolt and surrounded the British agent, Colonel Biddulph, who was in a very critical position. Colonel Tanner was immediately directed to return to Gilgit in command of a detachment of the troops of the Maharajah of Kashmir, and he relieved Colonel Biddulph in a very satisfactory manner. During the period that Colonel Tanner had thus been located in Gilgit, he mapped, with the aid of two native surveyors, an area of about 4000 square miles of this most interesting region, which had previously been almost a *terra incognita*. The survey of Gilgit was completed, and extended into the Astor valley towards the chief passes which lead into the Indus valley on the one hand and into Kashmir on the other. The whole region is a wild mass of lofty mountains, and the hardships and dangers involved in surveying such a tract of snow-clad peaks and glaciers are necessarily very great. In one part, Colonel Tanner visited eight survey stations, varying from 15,000 to 17,500 feet above the sea. To give an idea of what the country is like and what he went through, the following extract is taken from one of his reports: "I must not omit to mention the most interesting point in all this wild mountain region, which in September last, after two unsuccessful attempts, I was able to reach. I had long wished to obtain a near view of the northern slopes of Nanga-parbat and of its glacier valleys which join the Indus opposite the independent settlement of Gor, and after a most perilous passage over a narrow rugged ridge surrounded by enormous precipices which tried my nerves to the utmost, I found myself confronted by what is probably the most magnificent snow view on the globe, embracing as it does a slope of nearly 24,000 feet (vertical measurement), with its glaciers, snow-fields, ice-cliffs, and jagged needles of naked rock extending from the summit of this king of mountains down to the Indus, which flows in a deep channel at its base. My feeble pen is unequal to the task of giving any adequate description of this superb and impressive view, which I contemplated from the edge of a tremendous precipice whose summit is 16,000 feet above the sea, and which rises sheer and unbroken from the forests and vineyards of Gor, situated an immense depth below me."

Colonel Tanner returned from Gilgit in April, 1882, and, after a few months' absence on leave to England, was posted in November, 1882, to the charge of the Darjeeling party, which was engaged in the surveys of independent Sikkim and of the Nepal boundary, in the Eastern Himalayas. He was engaged on these operations for the next three years, and there his work was of an entirely different kind, for he was no longer able to go about through the mountains from point to point, but was obliged to remain on or outside the frontier, and from there fix the peaks of the Nepal ranges, making sketches, and getting such topographical information

as he could. Advantage was taken, however, of every opportunity of extending our knowledge in this part of the Himalayas by means of trained explorers, who were sent into Western Nepal, Bhutan, and Tibet, and much valuable information was thus obtained. Tanner himself managed to cross the Lipu Lak pass, at the north-east corner of Kumaun, and get into Tibet through some most interesting country, reaching a spot about 1½ mile from Takla Khár, where he was stopped and ordered back by the governor of that place. He was promoted to be colonel in June, 1884.

In November, 1885, the *locale* of operations of the party was changed to what may be called the Central Himalayas, and the surveys of Kangra, Kulu, Lahaul, and the native states about Simla were commenced. Colonel Tanner superintended these operations till October, 1890, when, though full of vigour and work, he was forced to retire from the Survey Department under the inexorable age rule. During his long and arduous labours in that department, of which the last twelve years had been spent—almost without a break—in the higher Himalayas, Colonel Tanner rendered very valuable service, and added materially to our knowledge of those mountain ranges and to the maps of those regions. No one, probably, was better acquainted with the characteristics of their principal features, for he had been employed on the extreme western ranges, those round Gilgit, and in the vicinity of the peak K_2, which is the second highest mountain known; from there he went into the Eastern Himalayas beyond Nepal and British territory, where he was in the vicinity of Kinchinjunga and Mount Everest, the highest peak yet determined; and, finally, he was in the Central Himalayas, in Kangra, Kulu, and Lahaul.

Colonel Tanner was an accomplished landscape painter, and during his travels through the Himalayas, he made good use of his talent in depicting the magnificent scenery he met with. His snow views, in black and white especially, are unsurpassed in beauty and skill; and his sketches, of which he had made a large collection, are works of art.

On his return to England, Colonel Tanner became a Fellow of this Society in 1891, and was a member of the Council from 1892 to 1894. In April, 1891, he contributed a very interesting paper on "Our Present Knowledge of the Himalayas," and subsequently papers on "Bar Sub-tense Survey" and "Photography as a Means of Surveying."

Of good physique and active habits, fond of adventure, careless of creature comforts, with great powers of endurance, and an intrepid mountaineer, Henry Tanner possessed all the qualities essential for arduous services in high altitudes. Kindly hearted, unselfish, and generous, he was a boon companion; and his genial and cheery manner endeared him to a host of friends, by whom his loss will long be felt.

Colonel Tanner was married in India, in 1859, to Minnie, daughter of Colonel C. R. Hogg, Bombay Fusiliers. His widow survives him, and he leaves five daughters to mourn his loss.

Commander Crawford A. D. Pasco, R.N.

The death of Commander Crawford Pasco, well known in Australia as a warm supporter of geographical enterprise in that quarter of the globe, has lately been announced from Melbourne. Commander Pasco entered the navy in 1830, and a few years later, when serving as mate of the *Britomart* under Captain Owen Stanley, took part in the foundation of the settlement of Port Essington, in North Australia. In August, 1839, he exchanged into the *Beagle*, then visiting Port Essington during the survey of the coasts of Australia carried out by that ship between 1837 and 1843,

in the latter of which years he obtained his commission as lieutenant. He subsequently took part in the naval operations on the coast of Borneo and in the Canton river, as well as in various other surveys. In 1845 he had received a commission under Sir John Franklin for the expedition in the *Erebus* and *Terror*, and it was only owing to an accident that he did not join his ship. Retiring with the rank of commander in 1866, he spent the latter years of his life in Australia, and was one of the founders (and subsequently Member of Council) of the Victorian Branch of the Geographical Society of Australasia. He entered warmly into the scheme of antarctic exploration set on foot in Australia in 1886, and presided over the joint committee of the Royal Society of Victoria and the Victorian Branch of the Geographical Society, appointed in furtherance of the scheme. In 1897 Commander Pasco published a work entitled 'A Roving Commission—Naval Reminiscences.' He became a member of our Society in 1873.

CORRESPONDENCE.

Sand-Dunes.

My friend Mr. E. A. Floyer, writing from Cairo, December 11, 1897, has sent me the accompanying notes on sand-dunes, which he kindly placed at my disposal. I have added a few notes, in square brackets. I think Mr. Floyer's observations cannot fail to be of interest.

Vaughan Cornish.

Branksome Cliff, Branksome Park, Bournemouth, March 14, 1898.

NOTES ON MR. VAUGHAN CORNISH'S PAPER ON "THE FORMATION OF SAND-DUNES." (*Geogr. Jour.*, March, 1897.)

By E. A. Floyer, F.G.S.

From observations on the dunes between Kuntara and El Arish of six consecutive waves measuring from east to west:—

	Height.	Length.	$\frac{\text{Length.}}{\text{Height.}}$
First wave	6·0 inches ...	118 inches ...	19·6
Second „	6·0 „ ...	118 „ ...	19·6
Third „	6·0 „ ...	118 „ ...	19·6
Fourth „	10·6 „ ...	145 „ ...	13·7
Fifth „	7·8 „ ...	135·8 „ ...	17·4
Sixth „	7·4 „ ...	118 „ ...	16·0

[The following are the measurements of ripples of blown sand at Branksome, Dorset, which were published in my paper. The agreement in the ratio $\frac{\text{length}}{\text{height}}$ is particularly interesting, in view of the different nature of the sand.]

Height.	Length.	Ratio.
$\frac{1}{16}$ inches	$1\frac{1}{4}$	20
$\frac{1}{15}$ „	$1\frac{3}{4}$	17
$\frac{1}{8}$ „	$2\frac{3}{8}$	17
$\frac{1}{8}$ „	$2\frac{1}{2}$	20
$\frac{1}{4}$ „	$4\frac{1}{4}$	17
$\frac{3}{16}$ „	6	16
$\frac{1}{2}$ „	7	14

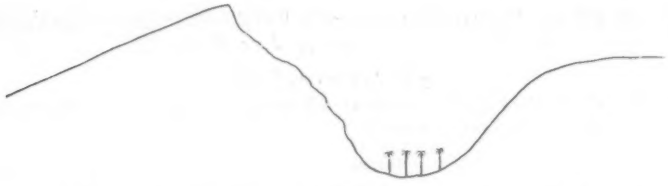
The windward slope was mosaiced, if the word be allowed, with the coarse sand

in bottle No. 1. [The samples of sand will be placed for inspection in the Map-room at the Society's House.]

The dominant wind is, at El Arish west, and at Kuntara west-south-west. It appears to curve from west-south-west to west. It is markedly dominant, and would appear, at the first glance, to have brought the sand from the deserts west

of the Nile and to be pouring it into the Mediterranean. The sand is moving over a flat hard surface, a vast sandy plain.

The district may be divided into half by a well called Bir el Abd. There are in the western half isolated dunes and masses of dunes. There are no fulges. There are no accurately shaped barchanes. One characteristic of a dune is that it holds



the water like a sponge. The steep leeward cliff often shelters a clump of date trees, some of which, but rarely, are smothered.

Sketch 1. We are looking west. The band of almost perpendicular sand, which is a characteristic of all these dunes, gives an appearance of a cowl. I think the suggestion would occur to others besides myself that these dunes resemble great sphinxes, over whose features a veil of sand is poured.

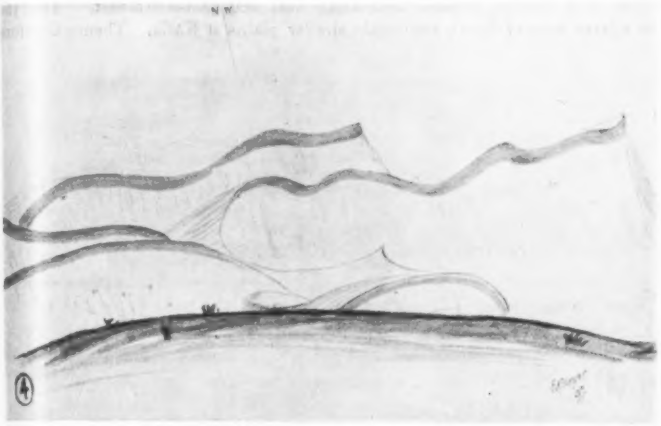
Sketches 2 and 3 are an approximate section of the dune and a plan of the date grove.

Sketch 4 emphasizes the cowl-like appearance. We were riding over a mass of dunes and looking north-west.

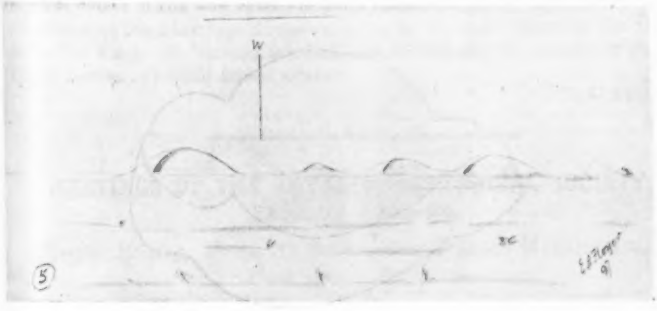
Sketch 5 shows the cowl-like appearance, and also that, west of Bir el Abd, the wind is west-south-west. We are looking west. We were standing at Katia and beholding, at a distance of 4 or 5 miles, the mass of dunes which we were about to cross, and which are shown in Sketch 4.

Sketch 6 shows a typical small cluster of dunes.

Sketch 7 is a theoretical, roughly sketched, ground plan of the dune shown in Sketch 6.



Sketch 8 is a view to our right as we march west. I have made no observations as to the strength of the wind, but I have often been surprised to find the sand motionless in a wind that seemed very high. Often the sand will be moving on one dune, and quiet on all the neighbouring dunes. [Dr. Blandford has pointed out that electrification is probably an important factor in the mobility of sand.] It

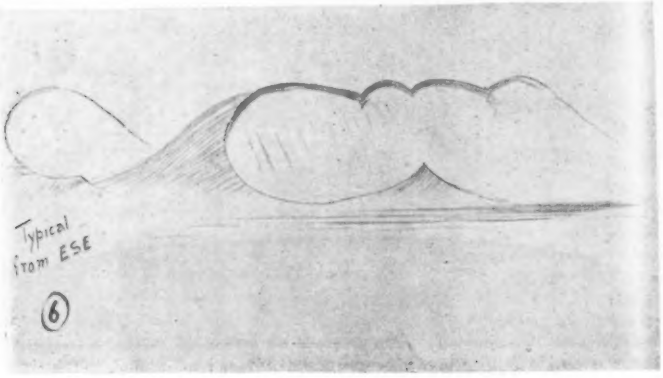


may be true that a small stream may arrest a moving dune. At El Arish, the west of the valley, which carries water for a few days yearly, is dune, while the east is friable yellow mud. Most of the dunes got where they are before the Suez Canal was dug. But I have seen sandstorms which, though the wind has not been excessive, have carried a great deal of very coarse sand across the canal.

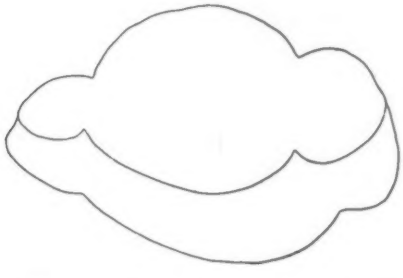
Between Halfa and Assuan a violent west wind is common. While it blows,

the golden sand may be seen pouring into the Nile. But at low Nile much of this resumes its journey eastward. The Egyptians have a rhyme saying, "We suffer, on the west, from the sand encroachments; on the east, from the marauders."

Starting from Kuntara, you march over a salt plain sprinkled with sand and studded with bushes, striated west-south-west and east-south-east. You then cross a large mass of dunes, and regain similar plains at Katia. Thence the dunes



are lower, and generally fixed. They run in broad east-and-west ridge and furrow. When fixed by bushes, the steep leeward cliff becomes less steep. Grazing camels tread it down, and it is ploughed and sown with barley. Marching east, the dunes get nearer the coast. At El Arish they are near the sea, and beyond El Arish they form, on the edge of the sea, a long east-and-west range, with a copious supply of fresh water on the north, and on the south are large and fertile plains sown with



barley. Some 20 miles to the south are apparently other dunes, too distant for any characteristics to be observed.

I do not find myself able to imagine any obstacle being permanent in the desert. Stones, trees, everything becomes sand.

When approaching from the east, and about 2 miles from the dunes, I collected some sand. The upper layer, rather coarse, is bottle No. 2. The under layer is bottle No. 3. The sand from the leeward side of the dune is bottle No. 4.

[Mr. Floyer's *sand-cowl* I take to be a form imparted by erosion. Since receiving the above notes, I have seen in operation the process by which, I think, it is produced. This was at the sandhills at the entrance to Poole Haven. A cowl, which culminated in a slightly overhanging cornice, was being carved by

the sweep of the wind from a small dune of unbound but compacted sand. The dune had then been built about twelve months, and pressure, moisture, and so forth, had given coherence to the mass, whilst leaving the sand-grains discreet. When in such condition, sand-structures are readily modelled to the swirling eddies of the wind.]

Mrs. Bishop's 'Korea.'

April 17, 1898.

From Mr. Chisholm's statement in his review of 'Korea and her Neighbours,' corroborated by a communication from the Rev. L. O. Warner, formerly of "Bishop Corfe's Mission," in answer to a question which I addressed to him with regard to his Korean journeys, I learn with much regret and vexation that, owing to a mistake, which had a very simple origin, I have unwittingly deprived him of the distinction of being the first European to get up the south branch of the Han, as far as Tan Yang. On learning this fact, I am anxious that the missionary traveller should receive full credit for his journey.

I. L. Bishop.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1897-98.

Special Meeting, March 23, 1898.—Sir Clements Markham, K.C.B., President, in the Chair.

The Paper read was:—

"The Geography and Resources of the Klondike Region." By William Ogilvie, of the Canadian Geological Survey.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

EUROPE.

Andorra. *Rev. Française* **23** (1898): 129–146. **Douchet.**
La Principauté d'Andorre et la question Andorrane. Par H. Douchet. *With Map and Illustration.*

Austria. ———
Az ausztriai császári czim fölvételéről. Székfoglaló Értekezés.—Értekezések a Társadalmi Tudományok Köréből. XII. Kötet. 2. Szám. Budapest, 1897. Size 9½ × 6½, pp. 40.

Austria-Hungary. *Nineteenth Century* **43** (1898): 466–480. **Reich.**
Austria-Hungary and the Ausgleich. By Dr. Emil Reich.

Denmark. *B.S.G. Com. Paris* **19** (1897): 807–812. **Castonnet des Fosses.**
Une excursion en Danemark. Le peuple danois. Par M. H. Castonnet des Fosses.

Europe—Political. *G.Z.* **4** (1898): 143–156. **Ratzel.**
Politisch-geographische Rückblicke. I. Allgemeines—Mittel Europa mit Frankreichs. Von Friedrich Ratzel.

A study of the relative power of the three states of Central Europe—France, Germany, and Austria-Hungary—not from the military, but from the social and geographical standpoint. Stress is laid on the rapid increase of population in Germany, its stationary character in France, and on the great areas of land awaiting development in Austria-Hungary.

France. *Spelunca* **3** (1897): 164–178. **Albe.**
"Glanures" Spéléologiques sur le Causse de Gramat (Lot). Par M. l'abbé Albe. *With Illustrations.*

France. *Spelunca* **3** (1897): 155–163. ———
Utilisation de Vaucluse et des sources des régions calcaires. Par M. X——.

France. *C. Rd.* **126** (1898): 554–557. **Kilian and Haug.**
Sur l'origine des nappes de recouvrement de la région de l'Ubaye. Note de MM. W. Kilian et E. Haug.

France. *A travers le Monde, Tour du Monde* **4** (1898): 65–68. ———
Monuments mégalithiques du Haut-Bourbonnais et d'Auvergne. Coupelles et Pierres à sacrifices. Par Gabriel G——r. *With Illustrations.*

France—Jura. *Spelunca* **3** (1897): 189–193. **Viré.**
Le Gouffre de la Pissière près Arbois (Jura). Par M. Armand Viré.

France—Muron. *B.S.G. Rochefort* **19** (1897): 225–255. **Arnaud.**
Muron et ses environs. Par M. Frédéric Arnaud. *With Map.*
Muron is a town about 10 miles from Rochefort.

Germany. *Questions Diplomat. et Colon.* **2** (1898): 275–292. **Blondel.**
L'essor industriel et commercial du Peuple Allemand. Par Prof. Georges Blondel.

Germany—Northern lakes. **Ule.**
Forschungen zur deutschen Landes- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. Elfter Band. Heft 2. Beitrag zur physikalischen Erforschung der Baltischen Seeen. Von Dr. Willi Ule. Stuttgart: J. Engelhorn, 1898. Size 9½ × 6½, pp. [50]. *Plates.*
This will be noticed along with other limnological works.

Germany—Saxony. *Z. k. Sächs. Statist. Büreaus* **43** (1897): 142–155. **Ganzenmüller.**
Die Fruchtbarkeits- und Sterblichkeitsverhältnisse in sämmtlichen Städten Sachsens während des Jahrfünfts 1891 bis 1895. Von Dr. Konrad Ganzenmüller.

Germany—Schleswig. *Aus allen Weltteilen* **29** (1898): 189–194. **Petersen.**
Die Ansiedelung deutscher Landleute in der Nordmark. Von Rektor Petersen. *With Map and Illustrations.*
With special reference to the settlement of German-speaking people in the neighbourhood of Rödding, close to the Danish frontier.

Germany—Thuringia. *Die Natur* **47** (1898): 127–129. **Reischel.**
Deutsche Landschaften. Abriss der Entwickelungsgeschichte Thüringens. Von Gustav Reischel.

Germany—Thuringia. **Walther.**
Thüringer Landschaftsformen erläutert aus ihrem geologischen Bau. Von Prof. Dr. Johannes Walther.—Verhandlungen des Zwölften Deutschen Geographentages Jena 1897. Berlin: D. Reimer, 1897. Pp. 210–224.

Greece. **Frazer.**
Pausanias's Description of Greece. Translated with a Commentary by J. G. Frazer. In six volumes. London: Macmillan & Co., 1898. Size 9 × 6, pp. (vol. i.) xcvi. and 616; (vol. ii.) viii. and 582; (vol. iii.) x. and 652; (vol. iv.) viii. and 448; (vol. v.) 638; (vol. vi.) 200. *Maps, Plans, and Illustrations. Price* £6 6*s.*
A work of such magnitude and research as this is rarely published, and it will form the subject of a special article. Vol. i. contains an introduction, and a translation of the text of Pausanias; vols. ii. to v. contain Mr. Frazer's monumental "notes" on the text, copiously illustrated by maps; and vol. vi. is a full index to the whole.

Greece—Athens. *B.S.R.G. d'Anvers* **21** (1898): 313–341. **Hauttecœur.**
Athènes. Par M. H. Hauttecœur.

Hungary—Transylvania. ———
Monumenta Comitialia Regni Transylvaniæ. Erdélyi Országgyülési Emlékek. XIX. Kötet (1686–1688.) Budapest, 1896. Size 10 × 6½, pp. 534.

Italy—Lago di Garda. *Petermanns M.* **44** (1898): 17–21. **Fischer.**
Das Moränen-Amphitheater des Garda-Sees. Von Prof. Dr. Theobald Fischer. *With Profile.*

Italy—Tuscany. *Riv. G. Italiana* **5** (1898): 38–49. **Mori.**
L'aumento della popolazione in Toscana negli ultimi secoli. Di Attilio Mori.

Mediterranean. *Deutsche Rundschau G.* **20** (1897-98): 1, 66, 103, 150. **Radde.**
Zwei Fahrten in das Mittelmeer in den Jahren 1895 und 1897 auf den kaiserl. russischen Yachten "Polarstern," und "Sarniza." Von Dr. G. Radde. *With Illustrations.*

Mediterranean—Crete. *Blackwood's Mag.* **163** (1898): 165–179. **Bennett.**
Amongst the Cretan Insurgents. By Ernest N. Bennett.

Mediterranean—Lampedusa. *Rev. G.* **42** (1898): 94–100. **Brunet.**
Un projet de colonisation Russe dans la Méditerranée au XVIII^e^ siecle. Par L. Brunet.
About 1785 Potemkin, minister of Catherine II., entertained the project of establishing a station for the Russian fleet on Lampedusa, a small island between Sicily and the African coast.

Mediterranean—Lampedusa. **Magistris.**
La pesca delle spugne nel Mar di Lampedusa. L. F. de Magistris. (Estratto dal *Giornale Italiano di pesca e acquicoltura*, N. 1–2, 1897.) Size 10 × 7, pp. 12.

Mediterranean—Malta. *J.R. United Service I.* **42** (1898): 115–127. **Bedford.**

The Great Siege of Malta, 1565. By the Rev. W. K. R. Bedford. *With Illustrations.*

The illustrations include copies of four of the engravings from paintings made in 1601, of the chief events of the great siege of 1565.

Mediterranean—Samos. *B.S.G. Commerc. Paris* **19** (1897): 599–609. **Bourge.**

L'Ile de Samos. Par Georges Bourge.

Norway. ———

Winter Life in Norway descriptive of Sports and Pastimes on Ice and Snow, edited by the Norwegian Winter Tourist Association. 1898. Christiania: Printed by W. C. Fabritius & Sønner. Size 5½ × 8, pp. 86. *Map and Illustrations.*

Norway—Christiania. *Norske G.S. Aarbog* **8**, 1896-97 (1897): 77–113. **Bjørlykke.**

Cand. real. K. O. Bjørlykke: Geologiske billeder fra Kristiania by. *With Illustrations.*

Norway—Historical. *Norske G.S. Aarbog* **8**, 1896-97 (1897): 37–52. **Storm.**

Prof. dr. Gustav Storm: Venetianerne paa Røst i 1432. *With Map.*

On a voyage of the Venetians to 67° 31′ N. on the coast of Norway in 1432.

Pyrenees. *Questions Diplomat. et Colon.* **2** (1898): 236–239. **Contenson.**

Le percement des Pyrénées centrales. Par M. le Comte G. de Contenson.

On the proposed Pyrenean tunnel under the Col du Sumport, the advantage of which is stated to be all on the side of Spain, and not on that of France.

Pyrenees—Val d'Aran. *B.S. Languedoc. G.* **19** (1896): 494–504. **Viala.**

Le val d'Aran et les sources de la Garonne. Par L. Fernand Viala.

The Val d'Aran is the Spanish valley on the northern slope of the Pyrenees, in which the Garonne takes its rise.

Russia. *G.Z.* **4** (1898): 133–143. **Credner.**

Reiseskizzen aus dem Ural und dem Kaukasus. Zwei Vorträge von Prof. Dr. Hermann Credner in Leipzig.

Description of a tour through the Ural and the Ossete country of the Caucasus.

Russia. *Questions Diplomat. et Colon.* **2** (1898): 212–215. ———

La Russie dans l'Océan Glacial Arctique. Le port Catherine. Par un ingénieur Russe. *With Map.*

A description of the new Russian port of St. Catherine (Jekaterinskaya Gavanzh), on the Murman coast, in lat. 69° 15′ N., long. 33° 30′ E.

Russia. *B.S.G. Marseille* **21** (1897): 231–253. **Saint-Yves.**

De la Volga à la frontière Sibérienne, l'Oural méridional. Par M. G. Saint-Yves.

Russia—Agriculture. *Rev. Scientifique* **8** (1897): 744–748. **Zograf.**

Les problèmes de l'acclimatation en Russie. Par M. Nicolas Zograf.

On the introduction of new plants and animals of economic value in Russia, both European and Asiatic.

Russia—Baltic Coast. ———

Description of Lighthouses, Beacons, and Landmarks of the Russian Empire along the Baltic Coast. Published by the Hydrographical Department, Ministry of Marine. St. Petersburg, 1897. Size 9 × 6, pp. 533. [In Russian.]

ASIA.

Asia Minor. *Travel* **2** (1898): 494–498. **Ramsay.**

Through the Cilician Gates to Tarsus. By Mrs. W. M. Ramsay. *With Illustrations.*

Asia Minor. **Zimmerer.**

Deutsche Forschung in Kleinasien. Von Dr. Heinrich Zimmerer. Verhandlungen des Zwölften Deutschen Geographentages Jena, 1897. Berlin: D. Reimer, 1897. Pp. 30–54.

Asiatic Turkey. **Oberhummer.**

Reise durch Syrien und Kleinasien im Jahr 1896. Von Roman Oberhummer, jr. Verhandlungen des Zwölften Deutschen Geographentages Jena 1897. Berlin: D. Reimer, 1897. Pp. 55–68.

Assyrian Geography. *Z. Deutsch Morgenländ. Ges.* **51** (1897): 555–568. **Belck.**

Hanigalbat und Melitene. Von W. Belck.

Central Asia. *C. Rd., S.G. Paris* (1898): 14–38. **Hedin.**

Séance extraordinaire.—Réception du Dr. Sven Hedin, explorateur dans l'Asie centrale.

China and Japan. *Contemporary Rev.* **73** (1898): 403–414. **Mitchell-Innes**

The Dragon and the Chrysanthemum. By N. G. Mitchell-Innes.

A contrast between China and Japan, with the object of confuting the not uncommon error that the people of both countries are very much alike.

China—Kiau-Chou. *Deutsche Rundschau G.* **20** (1898): 266–268. ——

Eine deutsche Beschreibung Kiao-tschaus. *With Map.*

Reproduction from a Shanghai paper of an article describing Kiau-Chou, by a German resident in the far East.

China—Manchuria. *B.S.G. Com. Paris* **19** (1897): 822–830. **Pozdéieff-Raffalovich.**

Description de la Mandchourie rédigée par M. Pozdéieff, sous la direction de M. Romanoff. (Analyse de M. A. Raffalovich.) *With Map.*

China—Manchuria. *Nineteenth Century* **43** (1898): 481–493. **Younghusband.**

The Future of Manchuria. By Captain F. E. Younghusband.

Chinese Empire. *B.S.G. Com. Paris* **19** (1897): 801–806. **Bonin.**

Les grandes voies commerciales de l'Asie centrale. Par M. Ch.-E. Bonin.

On routes in Tibet and Mongolia.

Cochin-China. *Questions Diplomat. et Colon.* **2** (1898): 129–136. **Vilers.**

Une colonie française de la fin du XIX^e^ siècle. Par Le Myre de Vilers.

An account of the progress and present state of the French colony of Lower Cochin-China.

India. *Fortnightly Rev.* **63** (1898): 390–400. ——

The Tirah Campaign. By an Eye-witness. *With Map.*

While the article is to a large extent critical of the military operations, it includes an account, with a map, of the engagements of October 18 and 20, 1897, on the Samana hills.

India—Baluchistan. *Scottish G. Mag.* **14** (1898): 137–149. **Yates.**

Chaman. By Major A. C. Yates. *With Illustrations.*

India—Burma. *C. Rd. S.G. Paris* (1898): 5–10. **Gallois.**

La Birmanie; les pagodes et les monastères; le cours de l'Irraouaddy. Par E. Gallois. *With Illustration.*

Report of a lecture describing a visit to Mandalay.

India—Burma. *Mem. Geolog. Surv. India* **27** (1897): 1–226. **Noetling.**

The occurrence of Petroleum in Burma, and its technical exploitation. By Dr. Fritz Noetling. *With Map and Plates.*

India—Gazetteer. **Bartholomew and Burgess.**

Constable's Hand-Gazetteer of India. Compiled under the direction of J. G. Bartholomew. Edited with additions by Jas. Burgess. London: A. Constable & Co., 1898. Size 7½ × 5, pp. 400. *Price* 10*s.* 6*d.* *Presented by the Publishers.*

A useful and accurate index of Indian places. Each entry has from one to three lines of information, giving position, statistics, and occasionally some important historical or industrial fact.

India—Jammu and Kashmir. **Bourbel.**

Routes in Jammu and Kashmir arranged topographically, with descriptions of Routes, Distances by Stages, and Information as to Supplies and Transport. Compiled . . . by Major-General le Marquis de Bourbel. Calcutta: Thacker, Spink & Co., 1897. Size 10 × 6½, pp. xvi. and 396. *Presented by the Author.*

This will be specially noticed.

India—Kashmir. **Darrah.**

Sport in the Highlands of Kashmir, being a Narrative of an Eight Months' Trip in Baltistan and Ladak, and a Lady's Experiences in the latter Country; together with Hints for the guidance of Sportsmen. By Henry Zouch Darrah. London: Rowland Ward, 1898. Size 9½ × 7, pp. xviii. and 506. *Maps and Illustrations. Price* 21*s.* *Presented by the Publisher.*

This fine work will be specially noticed.

India—North-West Frontier. ——

Military Operations on the North-West Frontiers of India. Papers regarding British Relations with the Neighbouring Tribes on the North-West Frontier of

India, and the Military Operations undertaken against them during the year 1897–1898. 2 vols. London: Eyre & Spottiswoode, 1898. Size 13 × 8½, pp. (vol. i.) viii. and 176; (vol. ii.) x. and 182. *Price* (vol. i.) 1*s.* 10½*d.*; (vol. ii.) 2*s.*

Japan. *B.S.G. Com. Havre* **14** (1897): 109–117, 131–138, 214–223. **Franconie.**

Le développement économique du Japon depuis la guerre contre la Chine. Par J. Franconie. (Extrait des *Annales de l'École libre des sciences politiques.*)

Malay Archipelago—Amboina. **Wichmann.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **15** (1898): 1–20.

Der Wawani auf Amboina und seine angeblichen Ausbrüche. Von Arthur Wickmann. *With Map.*

A criticism of the recorded eruptions of Wawani from 1672 to 1824, with extracts from the description of each outbreak, in order to show that these records do not prove that Wawani is a volcano.

Malay Archipelago—Borneo. *Petermanns M.* **44** (1898): 9–13. **Nieuwenhuis.**

Die Durchquerung Borneos durch die niederländische Expedition 1896–1897. Von Dr. A. W. Nieuwenhuis. *With Map.*

Malay Archipelago—Celebes. **Kruijt.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **15** (1898): 46–52.

De opsporing van het Lindoe-meer op Celebes. Door Alb. C. Kruijt.

On the exploration of Lake Lindoe, in Celebes.

Malay Archipelago—Java. *Naturw. Wochenschrift* **13** (1898): 112–113. **Fürst.**

Der Vulcan Lamongan. Von Dr. E. Fürst.

Lamongan is stated to be one of the smallest but most active volcanoes in Java; it rises in two symmetrical cones 5238 feet high, and is situated in the province of Probolinggo.

Russia—Caucasus. *Materials Topog. Ethnolog. Caucasus* **22** (1897): Pt. 1, 1–49. ——

Description of mounds in Kurdzhinskaya and Gabukai villages, Gov. Kuban. *Plan and Illustrations.* [In Russian.]

Russia—Caucasus. *Iz. Imp. Russian G.S.* **32** (1897): 1–33. **Bush.**

Preliminary Report on a Journey in North-Western Caucasus, 1896, for the investigation of its Flora and Glaciers. By N. A. Bush. [In Russian.]

Russia—Caucasus. **Dzhorbenadze.**

Materials Topog. Ethnolog. Caucasus **22** (1897): Pt. 2, 239–247.

The Negoiti Village and its Inhabitants, Gov. Kutais. By C. Dzhorbenadze. [In Russian.]

Russia—Caucasus. **Dzhanashvali.**

Material Topog. Ethnolog. Caucasus **22** (1897): Pt. 1, 1–206.

Georgian Annals and Historians on the Northern Caucasus and Russia. By M. Dzhanashvali. [In Russian.]

Russia—Caucasus. **Kereselidze.**

Materials Topog. Ethnolog. Caucasus **22** (1897): Pt. 2, 210–238.

The Gebi Village and its Inhabitants, Gov. Kutais. By D. Kereselidze. [In Russian.]

Russia—Caucasus. **Leontiyeff.**

Materials Topog. Ethnolog. Caucasus **22** (1897): Pt. 2, 119–162.

A Journey to the Baksan Glacier. By I. Leontiyeff. [In Russian.]

Russia—Caucasus. *Mem. Comitĕ Geologique, Russia* **14** (1896): No. 1. **Mushketoff.**

Geological Sketch of the Glacier Region of the Teberda and the Chkhalta in the Caucasus. By Prof. I. V. Mushketoff. *With Geological Map and Sections.* [In Russian.]

Russia—Eastern Siberia. *Ann. G.* **6** (1897): 385–407; **7** (1898): 1–13. **Woeikof.**

Le climat de la Sibérie orientale comparé à celui de l'Amérique boréale. Par M. A. Woeikof.

A note on this paper appeared in the *Journal* for March, p. 296.

AFRICA.

Africa—Colonisation. *B.S. Languedoc. G.* **20** (1897): 103–144. **Duponchel.**

La Colonisation africaine et le chemin de fer de Madagascar. Par M. A. Duponchel.

The introduction deals with the general subject of the aid afforded by railways to colonisation, and the main subject of the memoir is the special advantages likely to be secured by the construction of railways in Madagascar.

Africa—Travels. **Decle.**

Three Years in Savage Africa. By Lionel Decle. With an Introduction by H. M. Stanley, M.P. London: Methuen & Co., 1898. Size 9½ × 6, pp. xxxii. and 594. *Maps and Illustrations. Price* 21*s. Presented by the Publishers.*

This description of a journey from the Cape to Uganda overland will be referred to along with other books on Africa.

Africa—Travels. **Vandeleur.**

Campaigning on the Upper Nile and Niger. By Lieut. Seymour Vandeleur. With an Introduction by Sir George T. Goldie, K.C.M.G., etc. London: Methuen & Co., 1898. Size 8½ × 6, pp. xxviii. and 320. *Portrait, Maps, Plans, and Illustrations. Price* 10*s. Presented by the Publishers.*

This will be noticed along with other recent books on Africa.

Algeria. *Questions Diplomat. et Colon.* **2** (1898): 137–182. **Mandeville.**

L'Algérie Méridionale et le Touat. Par — Mandeville. *With Maps.*

British East Africa—Uganda. *Miss. Catholiques* **30** (1898): 61–65. ———

Les derniers événements de l'Ouganda.

Congo State. *Mouvement G.* **15** (1898): 130–133. **Cornet.**

Les travaux de M. Jules Cornet sur le Congo.

A summary of M. Cornet's geological researches.

East Africa. *Fortnightly Rev.* **63** (1898): 362–377. **Edwards.**

The French on the Nile. By F. A. Edwards. *With Map.*

A careful study of recent movements in the upper Nile valley, remarkable for the command of contemporary sources of information, and the number of references with which the discussion is fortified.

Egypt. *B. American G.S.* **30** (1898): 15–27. **Eaton.**

From Cairo to Beni-Hassan. By D. Cady Eaton.

Refers largely to Egyptian inscriptions.

Egypt—Census. **Boinet Bey.**

Recensement Général de l'Égypte. 1er Juin, 1897—1er Moharrem 1315. Rapport préliminaire. Size 13 × 10, pp. 54. *Presented by the Société Khédiviale de Géographie.*

In 1897 the population of Egypt to Wadi Halfa was ascertained as 9,734,405. Of these 107,050 were Europeans, the countries most largely represented being—Greeks, about 38,000; Italians, 24,000; British, 20,000; French, 14,000. Of the whole population over 92 per cent. were Mussulmans, and 7½ per cent. Christians.

Madagascar. *Antananarivo Annual* **6** (1897): 94–100. **Foster.**

Early Notices of Madagascar from the Old Voyagers. Part vi. The Narrative of John Dean as to the Wreck of the *Sussex* Indiaman, 1738. By William Foster. *With Portrait.*

Madagascar. *B.S.R.G. d'Anvers* **21** (1898): 290–311. **Locamus.**

Madagascar et l'alimentation Européenne. Par M. P. Locamus.

Madagascar. *Antananarivo Annual* **6** (1897): 53–60. **Pearse.**

From Fianarantsoa to Masindrano (or Mananjara). By Rev. J. Pearse.

A journey in 1896 from Fianarantsoa, the capital of the Betsileo province, to the rising seaport Masindrano, which, however, has no harbour, the freight and passengers having to be transferred between the ship and the shore in native surf-boats. The writer throughout refers in the most favourable manner to the French soldiers and officials in the island.

Madagascar. *Antananarivo Annual* **6** (1897): 22–31. **Roblet.**

The History of a Map: Adventures and Experiences in Surveying in Madagascar. Translated from the French of Rev. D. Roblet, S.J., by Rev. J. Sibree.

It is pleasant to see this tribute rendered by an English Protestant missionary in Madagascar to the labours of a French Roman Catholic missionary, whose production of a map of a large part of the country, under circumstances which were often dangerous and always trying, is here described.

South Africa. **Worsfold.**

The Story of South Africa. By W. Basil Worsfold. (The Story of the Empire Series.) London: H. Marshall & Son, [1898]. Size 7 × 4½, pp. 176. *Price* 1*s.* 6*d.* *Presented by the Publishers.*

A brief but well-balanced epitome of the growth of European predominance in South Africa from the voyage of Vasco da Gama.

South Africa—Rainfall. **Buchan.**

Cape of Good Hope. Meteorological Commission. A Discussion of the Rainfall of South Africa during the ten years 1885–94. [With sixteen explanatory Maps.] By Alexander Buchan. Cape Town, 1897. Size 13½ × 8½, pp. 34. *Presented by Dr. Morris.*

This will be specially noticed.

South Africa—Transvaal. *Engineering Mag.* **14** (1898): 733–751. **Hammond.**

The Gold Mines of the Witwatersrand, South Africa. By John Hays Hammond. *With Illustrations.*

South and East Coasts of Africa. **Horsey.**

The Africa Pilot. Part iii. South and East Coasts of Africa, from the Cape of Good Hope to Ras Asir (Cape Guardafui), including the Comoro Islands. Originally compiled by Captain Algernon F. R. de Horsey. Sixth Edition. London: J. D. Potter, 1897. Size 9½ × 6, pp. xxiv. and 634. *Index charts. Price* 4*s. Presented by the Hydrographic Office, Admiralty.*

South-West Africa. **Schwabe.**

Illustrirte Beilage Deutsch. Kolonialzeitung (1898): 35–36.

Von der südwestafrikanischen Eisenbahn. Von Premier-Lieut. Schwabe. II. *With Sketch-Map and Illustrations.*

NORTH AMERICA.

Alaska—Kuskokwim River. *National G. Mag.* **9** (1898): 85–92. **Hallock.**

Two Hundred Miles up the Kuskokwim. By Charles Hallock. *With Illustrations.*

The Kuskokwim is an Alaskan river 800 miles long.

Canada. *Nineteenth Century* **43** (1898): 494–514. **Kropotkin.**

Some of the Resources of Canada. By Prince Kropotkin.

Canada—Newfoundland and Labrador Pilot. **Maxwell.**

The Newfoundland and Labrador Pilot, comprising also the Strait of Belle-Isle, the North-east and part of the North coast of Labrador. Originally compiled by Staff Commander W. F. Maxwell, R.N. Third Edition. London: J. D. Potter, 1897. Size 9½ × 6, pp. xxiv. and 782. *Index-Charts. Presented by the Hydrographer, Admiralty.*

Canada—Yukon District. *B.S.R.G. d'Anvers* **21** (1898): 342–364. **Richet.**

Au Klondyke (Notes de route). Par M. Étienne Richet.

Mexico—Yucatan. *B.S.G. Com. Havre* **14** (1897): 208–213. **Saumery.**

Au Yucatan. Par D. de Saumery.

A popular account of a visit to Yucatan.

United States—Dakota. *American J. Sci.* **5** (1898): 161–168. **Darton.**

Geothermal Data from Deep Artesian Wells in the Dakotas. By N. H. Darton. *With Maps.*

An interesting study of the increase of temperature downwards in deep artesian wells distributed over a considerable area in Dakota. The rate of increase from 1° Fahr. in 45 feet to 1° in less than 20 feet, and there is a distinct regional distribution of this increase of rate of rise of temperature, the greatest rate occurring along or immediately to the west of the Missouri river from Yankton to Pierre.

United States—Magnetic Declination. **Gannett.**

Magnetic Declination in the United States. By Henry Gannett. Seventeenth Annual Report of the United States Geological Survey . . . 1895–96. Part i. Pp. 211–440. *Diagrams.* Washington, 1896. Size 12 × 8.

United States—Massachusetts. **Abbott.**

The Vital Statistics of Massachusetts, 1856–95. By Samuel W. Abbott, M.D. [From the Twenty-Eighth Annual Report of the State Board of Health of Massachusetts for 1896.] Size 9½ × 6, pp. 713–844. *Diagram.*

United States—Michigan. **Van Hise, Bayley, Smyth.**

Department of the Interior. Monographs of the United States Geological Survey. Vol. xxviii. The Marquette Iron-bearing District of Michigan, with Atlas. By Charles Richard Van Hise and William Shirley Bayley, including a chapter on the Republic Trough, by Henry Lloyd Smyth. Washington, 1897. Size 12 × 9 (Atlas 21½ × 18½, 1896), pp. xxviii. and 608. *Maps and Plates. Presented by the Survey.*

United States—Mississippi. *National G. Mag.* **9** (1898): 24–27. **McGee.**

The Modern Mississippi Problem. By W. J. McGee.

A note on this paper will appear in the Monthly Record.

CENTRAL AND SOUTH AMERICA.

Barbados. **Fraser.**

The Barbados Diamond Jubilee Directory and General West Indian Advertiser. Compiled from latest official and other sources. By S. J. Fraser. Barbados: T. E. King & Co. Size 7½ × 5, pp. xxxii. and 260. *Maps and Plates. Presented by the Compiler.*

Bolivia. **Ballivián.**

Relaciones Geográficas de Bolivia existentes en el Archivo de la Oficina Nacional de Inmigración, Estadistica y Propaganda Geográfica. Relación y Descripción de las Misiones y conversiones de Infieles. La Paz, 1898. Size 8½ × 6½, pp. iv. and 40. *Presented by the Author.*

Bolivia. ———

Ministerio de Instruccion Publica y Fomento. Revista de la Oficina Nacional de Inmigracion, Estadistica y Propaganda Geografica. Año 1897. No. 1. La Paz. Size 9 × 6, pp. iv. and 246. *Map.*

British Guiana. *Timehri* **11** (1897): 284–293. **Bellairs.**

Our Peasant Population—Their Past Condition and Future Prospects. By Seaforth M. Bellairs.

On the economic condition of the labouring classes in British Guiana. All interested in the admirable work carried out by the conductors of *Timehri* will rejoice to hear that the magazine will not be discontinued, but will continue to appear, though somewhat reduced in size.

French Guiana and Brazil. *Questions Diplomat. et Colon* **2** (1898): 273-274. ———

Le Contesté Franco-Brésilien. Par X——. *With Map.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Mammalian Fauna. **Semon.**

Die Säugetier-Fauna Australiens. Von Prof. Dr. Richard Semon.—Verhandlungen des Zwölften Deutschen Geographentages Jena 1897. Berlin: D. Reimer, 1897. Pp. 167–180.

German New Guinea. ———

Nachrichten über Kaiser Wilhelms-Land und den Bismarck-Archipel. Herausgegeben von der Neu Guinea Compagnie zu Berlin. Berlin: A. Asher & Co., 1897. Size 9½ × 6½, pp. 102.

The annual report of the German New Guinea Company.

New South Wales. *Records Australian Museum* **2** (1893): 46–54. **Etheridge.**

Geological and Ethnological Observations made in the Valley of the Wollondilly River, at its Junction with the Nattai River, Counties Camden and Westmoreland. By R. Etheridge, junr. *With Plates.*

New Zealand. *T. Edinburgh Geolog. S.* **7** (1897): 183–200. **Cadell.**

A Visit to the New Zealand Volcanic Zone. By Henry M. Cadell. *With Maps and Illustrations.*

This visit was paid in 1895.

Queensland. **Hogan.**

The Gladstone Colony, an Unwritten Chapter of Australian History. By James Francis Hogan, M.P. London: T. Fisher Unwin, 1898. Size 9 × 6, pp. vi. and 278. *Price 7s. 6d. Presented by the Publisher.*

A summary of the curious history contained in this book will appear as a note

POLAR REGIONS.

Antarctic. **Neumayer.**

Thätigkeitsbericht der Deutschen Kommission für die Südpolar-Forschung. Von Prof. Dr. Neumayer.—Verhandlungen des Zwölften Deutschen Geographentages Jena 1897. Berlin: D. Reimer, 1897. Pp. 15–29.

Antarctic Expedition. *Nature* **57** (1898): 420–427. **Murray and others.**

Scientific Advantages of an Antarctic Expedition. Addresses by Dr. John Murray, F.R.S.; the Duke of Argyll; Sir Joseph Hooker, G.C.S.I., F.R.S.; Dr. Nansen; Prof. Dr. Neumayer; Sir Clements Markham, K.C.B., F.R.S.; Dr. Alexander Buchan; Sir Archibald Geikie, F.R.S.; Dr. P. L. Sclater, F.R.S.; and Prof. d'Arcy Thompson.

A full report of the meeting at the Royal Society on February 23, a more condensed account of which appears in the *Journal* for April, p. 416.

Antarctic Research. *Nature* **57** (1898): 413–416. **Mill.**

Antarctic Research. By Dr. Hugh Robert Mill. *With Chart.*

Gives the history of the present movement for antarctic explorations, and lays stress on the historical aspect of the question of the motive for polar research.

Greenland. **Drygalski.**

Grönland-Expedition der Gesellschaft für Erdkunde zu Berlin, 1891–1893. Unter Leitung von Erich von Drygalski. 2 vols. Berlin: W. H. Kühl, 1897. Size 12½ × 8, pp. [vol. i.] xx. and 556; [vol. ii.] x. 572. *Maps and Illustrations. Presented by the Gesellschaft für Erdkunde, Berlin.*

These splendid volumes will be separately noticed.

Polar Problems. *G.Z.* **4** (1898): 121–133. **Drygalski.**

Die Aufgaben der Forschung am Nordpol und Südpol, 1898. Von Dr. Erich von Drygalski.

Treats of the problems now remaining to be solved in the polar regions, north and south.

MATHEMATICAL GEOGRAPHY.

Circular Measurement. **Tilmant.**

Mémoire contre la division du cercle en 400 grades et en faveur de l'adoption du système de 240 degrés. Présenté à la Société de Géographie de Lille. Par M. V. Tilmant. Lille: Imp. L. Danel, 1898. Size 10 × 6½, pp. 32. *Presented by the Author.*

The circle has always been divided by all civilized nations into 360 degrees. It was divided, when the metric system was introduced, into 100 degrees; this was a failure: 400 degrees were proposed recently, and the author proves that this is impracticable, while 240 degrees, he considers, presents many advantages.

Cross-staff. *G.Z.* **4** (1898): 157–167. **Günther.**

Der Jakobstab als Hilfsmittel geographischer Ortsbestimmung. Von S. Günther. *With Illustrations.*

An account of the cross-staff in history, from its earliest mention early in the fourteenth to its latest use in the eighteenth century, with references to the geographers and discoverers who used it in determining positions.

Latitude Variations. **Albrecht.**

Centralbureau der Internationalen Erdmessung. Bericht über den Stand der Erforschung der Breitenvariation im December 1897. Von Th. Albrecht. Berlin: G. Reimer, 1898. Size 12 × 9, pp. 36. *Plate.*

Positions at Sea. **Johnson.**

A Hand-Book for Star Double-Altitudes: with directions for selecting the stars, and showing how a single observer may take both the altitudes. By A. C. Johnson, R.N. London: J. D. Potter, 1898. Size 10 × 6½, pp. 32. *Price* 2*s.* 6*d. Presented by the Publisher.*

The Tides. **Moxly.**

A Suggested Improvement of the Current Theories of the Tides. By J. H. S. Moxly. London: Rivingtons, 1898. Size 8½ × 5½, pp. 44. *Price* 3*s.* 6*d. Presented by the Author.*

Mr. Moxly puts forward a theory of the cause of the tides which, he states, accords better with observed facts than the theory commonly held.

Time and Angles. **Rey-Pailhade.**

L'extension du système décimal aux mesures du Temps et des Angles. Théorie et applications scientifiques et industrielles. Par J. de Rey-Pailhade. Paris: Gauthier-Villars & Fils, 1897. Size 9½ × 6, pp. 44. *Map and Plate. Presented by the Author.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Atolls. *Natural Science* **12** (1898): 174–178. **Hedley.**

The Broadening of Atoll-Islets. By Charles Hedley.

Earth—Interior. *J. Geology* **6** (1898): 65–78. **Slichter.**

Note on the Pressure within the Earth. By C. S. Slichter.

Geological Theories. *J. Geology* **6** (1898): 1–9. **Powell.**

An Hypothesis to account for the Movement in the Crust of the Earth. By J. W. Powell.

Geomorphology. *J. Geology* **6** (1898): 10–64. **Van Hise.**

Estimates and Causes of Crustal Shortening. By C. R. Van Hise.

Meteorology—Weather Forecasts. *Ann. Hydrographie* **26** (1898): 63–70. **Bebber.**

Einiges über Wettervorhersage insbesondere über das Sturmwarnungswesen an der deutschen Küste. Von Prof. Dr. W. J. van Bebber.

Mountains and Sunlight. **Peucker.**

Der Bergschatten. Die Einschränkung solarklimatischer Faktoren durch ein Bergprofil, und ihre graphische Ermittelung. Von Dr. Karl Peucker.—Verhandlungen des Zwölften Deutschen Geographentages Jena 1897. Berlin: D. Reimer, 1897. Pp. 225–252. *Plates.*

Oceanography. *Abrégé B.S. Hongroise G.* **25** (1897): 5–26. **Luksch.**

Die oceanographischen Forschungen der Neuzeit und Oesterreich-Ungarns Antheil an denselben. Von J. Luksch.

Oceanography—Skagerak. **Pettersson and Ekman.**

K. Svensk. Vetens.-A. Handlingar **29** (1897): 1–126.

De Hydrografiska Förändringarne inom Nordsjöns och Östersjöns område under tiden 1893–1897. Af Otto Pettersson och Gustaf Erkman. *With Plates.*

River-action. *C. Rd.* **126** (1898): 557–560. **Brunhes.**

Sur quelques phénomènes d'érosion et de corrosion fluviales. Note de M. Jean Brunhes.

Sand-dunes. *T. Edinburgh Geolog. S.* **7** (1897): 298–311. **Mackie.**

On the Laws that Govern the Rounding of Particles of Sand. By Wm. Mackie, M.A., M.D. *With Plates.*

A study of sand-particles, with reference to the dunes of the Culbin sands, west of the mouth of the Findhorn.

Seismology. **Gerland.**

Ueber den heutigen Stand der Erdbebenforschung. Von Prof. Dr. G. Gerland.—Verhandlungen des Zwölften Deutschen Geographentages Jena 1897. Berlin: D. Reimer, 1897. Pp. 99–117.

Seismology. **Supan.**

Vorschläge zur systematischen Erdbebenforschung in den einzelnen Ländern. Von Prof. Dr. A. Supan.—Verhandlungen des Zwölften Deutschen Geographentages Jena 1897. Berlin: D. Reimer, 1897. Pp. 118–123.

Seismology. ———

British Association for the Advancement of Science. Toronto Meeting, 1897. Second Report on Seismological Investigations. London: Offices of the Association. Size 8½ × 5½, pp. 78. *Diagrams.*

Seismology. *Nature* **57** (1898): 246–249, 272–276. **Milne.**

Recent Seismology. By Prof. J. Milne, F.R.S. *With Illustrations.*

Soil Temperature. **Callendar and McLeod.**

McGill University. Papers from the Department of Physics. No. 4. Observations of Soil Temperatures with Electrical Resistance Thermometers. By Hugh L. Callendar and C. H. McLeod. With Four Plates. [Reprinted from the

Transactions of the Royal Society of Canada, Second Series, 1896–97, vol. ii. section iii. pp. 109–117.] Montreal, 1897. Size 10 × 7.

Speleology—Bibliography. *Mém. S. Spéléologie* **1** (1897): 1–70. **Martel.**

Bibliographie spéléologique, 1895–1897. Par **M. E.-A. Martel.** *With Illustrations.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Körösy.**

Le recensement séculaire du Monde en 1900. Mémoire adressé à la session de St.-Pétersbourg de l'Institut International de Statistique. Par le Dr. Joseph de Körösy. Paris: Lib. Guillaumin et Cie., 1898. Size 10½ × 7½, pp. 34. *Presented by the Author.*

A plea for a universal census in 1900, with plans of schedules adapted for the purpose of giving strictly comparable data for all countries. The proposal was duly discussed at the St. Petersburg Statistical Congress, and reported on as impracticable, although eminently desirable.

Colonization. *Kolon. Jahrb.* **10** (1897): 243–269. ——

Der Togovertrag, extensive und wirthschaftliche Kolonialpolitik.

A discussion of the principles of colonisation, with particular reference to the delimitation of the German West African colony of Togo.

Commercial Geography. **Hahn.**

Die Transporttiere in ihrer Verbreitung und in ihrer Abhängigkeit von geographischen Bedingungen. Von Dr. Eduard Hahn.—Verhandlungen des Zwölften Deutschen Geographentages Jena 1897. Berlin: D. Reimer, 1897. Pp. 181–196.

Historical—Discovery of America. *National G. Mag.* **9** (1898): 73–84. **Horsford.**

Dwellings of the Saga-Time in Iceland, Greenland, and Vineland. By Cornelia Horsford. *With Illustrations.*

With numerous illustrations of early Scandinavian dwellings and certain remains supposed to represent similar buildings in Massachusetts.

BIOGRAPHY.

Bòttego. *Riv. G. Italiana* **5** (1898): 1–23. **Giuliani.**

Vittorio Bòttego. Dal Prof. Carlo Giuliani. *With Portrait.*

Drake. **Corbett.**

Drake and the Tudor Navy. With a History of the Rise of England as a Maritime Power. By Julian S. Corbett. 2 vols. London: Longmans & Co., 1898. Size 9 × 6, pp. (vol. i.) xvi. and 436; (vol. ii.) viii. and 488. *Portrait, Charts, and Illustrations. Price* 36*s. Presented by the Publishers.*

This is specially noticed on p. 527.

Gesner. *B. Nat. Hist. S. New Brunswick* **15** (1897): 3–48. **Matthew.**

Abraham Gesner. A Review of his Scientific Work. By G. F. Matthew, D.Sc. *With Maps.*

Gesner was concerned with the first investigations into the geology of the maritime provinces of Canada.

Gauthiot. *Deutsche Rundschau G.* **20** (1898): 277–280. **Paulitschke.**

Charles Gauthiot. Von Ph. Paulitschke. *With Portrait.*

Hedin. *Deutsche Rundschau G.* **20** (1898): 228–229. ——

Dr. Sven Hedin. *With Portrait.*

The portrait is not characteristic.

Hubbard. *National G. Mag.* **9** (1898): 33–70. ——

Gardiner Greene Hubbard. *With Portrait.*

The whole number is devoted to obituary notices of Mr. Hubbard, the late President of the National Geographic Society.

Lüddecke. *Deutsche Rundschau G.* **20** (1898): 280. ——

Richard Lüddecke. *With Portrait.* [Also *Petermanns Mitteilungen*, 44 (1898): 24.]

Dr. Lüddecke, born in 1859, died on January 14, 1898, was one of the accomplished cartographers on the staff of Herr Justus Perthes at Gotha.

Miller. *T. Edinburgh Geolog. S.* **7** (1897): 132-138. **Horne.**

Obituary Notice of Hugh Miller. By J. Horne. *With Portrait.*

Mr. Hugh Miller, son of the famous geologist, was born in 1850, and died in 1895. He was on the staff of the Geological Survey of Scotland, and was the author of many papers on the physical geography of the regions which he studied geologically.

Necrology of 1896 and 1897. **Wolkenhauer.**

Geographische Nekrologie für die Jahre 1896 und 1897. Von Dr. W. Wolkenhauer. Size 8½ × 6, pp. [28].

GENERAL.

Ballooning. **Claparède.**

Arthur de Claparède. De Genève à Cercier en Ballon. Notes d'un touriste dans l'espace. Genève: Georg & Co., 1898. Size 9 × 6, pp. 40. *Presented by the Author.*

British Colonies. **Greswell.**

The Growth and Administration of the British Colonies, 1837-1897. By Rev. William Parr Greswell, M.A. London: Blackie & Son, 1898. Size 7½ × 5, pp. 254. *Price 2s. 6d. Presented by the Publishers.*

Preliminary chapters are devoted to the British colonial system, and to pioneers of colonial progress and reform from Wakefield to Sir John Seeley. Then follow chapters on the growth of the North American, South African, and Australasian colonies, and of their constitutions. The author confines himself to the discussion of colonies in the true sense of the word.

British Empire—Trade. *J.R. Colonial I.* **29** (1898): 226-260. **Birchenough.**

Some Aspects of our Imperial Trade. By Henry Birchenough, M.A.

Educational Journeys. **Sievers.**

Ueber grössere geographische Unterrichtsreisen mit Studierenden. Von Prof. Dr. W. Sievers.—Verhandlungen des Zwölften Deutschen Geographentages Jena 1897. Pp. 93-96.

Educational—Methods. *J. School G.* **2** (1898): 92-96. **Dodge.**

First Steps in the Geography of the World. By Richard E. Dodge.

Hints as to practical methods of linking the geography of the world to the personal experience and observations of young children.

Educational—Methods. **Dryer.**

Geography as a University Study. By Charles R. Dryer. From the *Inland Educator*, 6, 1898. Size 11 × 7½, pp. [8].

Prof. Dryer gives a statement of the historical development and actual position of geography as a science, and then contrasts the developed state of geographical instruction (especially of a university order) in the countries of continental Europe with the disgraceful neglect in the universities of the English-speaking world.

Educational—Methods. **Fischer.**

Zur äusseren Lage des Geographie-Unterrichtes in Preussen. Von Oberlehrer H. Fischer.—Verhandlungen des Zwölften Deutschen Geographentages Jena, 1897. Berlin: D. Reimer, 1897. Pp. 69-92. *Plate.*

Educational—Textbook. **Lyde.**

A Geography of Europe. By Lionel W. Lyde. London: A. & C. Black, 1897. Size 7 × 5, pp. vi. and 120. *Price 1s. Presented by the Publisher.*

A clearly arranged school-book, divided into Lessons and subdivided into short numbered paragraphs.

Geographical Distances. *P.R. Artillery I.* **25** (1898): 133-145. **Cleeve.**

A System of comparing Geographical Distances. By Captain F. J. S. Cleeve.

The substance of this lecture was published in the *Geographical Journal* for September, 1897, vol. x. p. 334.

Geography. *Petermanns M.* **44** (1898): 14-17. **Kahle.**

Die Geographie auf der 69. Versammlung deutscher Naturforscher und Ärzte in Braunschweig, 1897. Von P. Kahle.

German Colonies.

Weissbuch. Achtzehnter Theil. Berlin: C. Heymann, 1898. Size 13 × 9½, pp. 156.

Annual reports on the German Colonies in Africa, and on the Marshall islands.

Irrigation. *B. American G.S.* **30** (1898): 1–14. **Wilson.**

Relations of Irrigation to Geography. By Herbert M. Wilson.

On the characteristics of a region which requires irrigation for agriculture.

Mohammedanism. **Robinson.**

Mohammedanism, has it any future? By the Rev. Charles H. Robinson, M.A. With an Introduction by the Right Rev. W. Boyd Carpenter, D.D. London: Gardner, Darton & Co. [1897]. Size 7½ × 5, pp. vi. and 84. *Presented by the Author.*

Portuguese Colonies. **Vasconcellos.**

As Colonias Portuguezas, geographia physica, politica e economica. Por Ernesto J. de C. E. Vasconcellos. Lisboa, 1896. Size 7½ × 5, pp. 444. *Presented by the Author.*

This was noticed in the *Journal* for August, vol. x. (1897), p. 178.

Routes to India. *Aus allen Weltteilen* **29** (1897): 155–160. **Ichenhäuser.**

Nach Ostindien über Deutschland. Von Dr. Justus Ichenhäuser.

This is noticed in the *Journal* for February, p. 175.

Royal Society—Year-Book. ——

Year-Book of the Royal Society of London, 1897-98. London: Harrison & Sons, 1898. Size 8½ × 5½, pp. 172. *Price 5s. Presented by the Royal Society.*

The second issue of this useful record of the activity of the Royal Society.

Scientific Progress. *P. American A. Arts and Sci.* **33** (1897): 31–42. **Livermore.**

Suggestions for the Development of the Arts and Sciences. By W. R. Livermore.

Refers incidentally to geography and the use of maps.

Second Italian Geographical Congress. **Magistris.**

L. F. de Magistris. Gli "Atti del Secondo Congresso Geografico Italiano." Roma, 1896. Size 9½ × 6, pp. 48. *Presented by the Author.*

Sixth International Geographical Congress. **Stern.**

Jahresb. Frankfurter Ver. G. u. Statistik **60** (1895–96), (1897): 115–133.

Der VI. Internationale Geographen-Kongress in London in Jahre 1895. Von Rudolf Stern.

One of the best general accounts of the Congress which has appeared, very happily characterizing the various features of the meeting, scientific and social. It is perhaps the highest compliment to the smoothness of the proceedings that the writer has not even had occasion to refer to the existence of secretaries of the Congress.

Time Signals. ——

List of Time Signals, established in various parts of the World. Fifth Edition, 1898. Compiled for the use of seamen, as an aid for ascertaining the errors and rates of chronometers. [Prepared from Official Sources to December 31, 1897.] London: J. D. Potter. Size 10 × 6½, pp. 68. *Price 1s. Presented by the Hydrographer of the Admiralty.*

Travel. **Hill.**

A Run round the Empire. Being the Log of Two Young People who circumnavigated the Globe. Written out by their Father, Alex Hill, M.A., M.D. London: Sonnenschein & Co., 1897. Size 7½ × 5½, pp. viii. and 286. *Illustrations. Price 3s. 6d. Presented by the Publishers.*

Dr. Hill made a journey round the world, by the Suez Canal to Australia, thence to New Zealand, across the Pacific and home by the Canadian Pacific railway and the Atlantic, the incidents of which are here recorded in a concise manner likely to interest young people. Dr. Hill believes that travel can be put to the best educational use by seeing the places first and reading about them afterwards. The book contains a number of fair illustrations, but no map.

Upsala University. **Geijer.**

Upsala Universitet, 1872–1897. Festskrift med anledning af Konung Oscar II.: satjugofemårs regerings jubileum den 18 September 1897. Enligt det Större Akademiska Konsistoriets Uppdrag, utgifven af Reinhold Geijer. Upsala, 1897. Size 12½ × 9½, pp. iv., 280, 360, and 104. *Portrait and Illustrations.*

The history of Upsala University during the reign of King Oscar II.

Water-Supply. *J.R. Agricultural S.* **8** (1897): 233–249. **Morley.**

The Use of Wind-Power in Village Water Supply. By A. L. Y. Morley. *With Illustrations.*

An account of the system of water-supply lately inaugurated at Great and Little Brington, Northamptonshire.

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Publications issued since March 8, 1893.

1-inch—General Maps:—

England and Wales (revision):—232, 244, engraved in outline; 247, hills engraved in black or brown. 1*s.* each.

6-inch—County Maps:—

England and Wales (revision):—**Essex**, 9 N.E., S.E., 12 S.W., 13 N.E., 14 S.W., 18 S.W., 23 N.E., 24 S.W., S.E., 25 N.E., 26 N.E., 28 N.W., 29 S.W., 31 S.E., 33 S.E., 36 S.W., 41 N.E., 50 N.W., S.E., 54 S.E., 58 N.E., S.W., S.E., 61 N.W., S.E., 63 N.W., N.E., 66 N.E., 67 N.W., S.W., S.E., 68 S.W., 69 N.E., 74 N.W., N.E., S.E., 75 S.E., 76 S.E., 77 N.W., N.E., 83 N.W., 84 N.W. **Hampshire**, 21 N.W., 44 N.E., S.W., 54 S.E., 62 S.E., 63 N.W., N.E., 64 N.W., S.W. **Kent**, 7 S.E., 8 N.W., N.E., S.W., 20 N.W., N.E., 28 N.E., 29 S.E., 30 N.W., N.E., 32 N.W., N.E., S.W., 40 N.W., 41 S.E., 44 S.E., 51 N.E., 61 N.E., 63 N.W. **Middlesex**, 8 N.W., 20 N.E. **Northumberland**, 66 S.E., 67 S.W., S.E., 68 N.E., S.W., 71 S.E., 75 N.W., N.E., S.W., S.E., 76 S.W., S.E., 78 S.W., 80 S.W., 82 S.E., 83 N.W., S.W., 84 N.W., N.E., S.E., 85 N.W., S.W., S.E., 86 N.W., S.W., 91 S.E., 92 S.W., 93 N.E., S.W., S.E., 94 N.E., S.W., 95 S.W., S.E., 100 S.E., 101 N.W., N.E., S.E., 102 N.W., N.E., S.E., 104 N.E., S.W., S.E., 106 N.W., 106A N.E., 108 N.E. **Surrey**, 13 N.W., 26 S.E., 39 N.W., S.W., 40 N.W., S.W. **London**, 4 N.W., S.E., 8 N.E., 10 S.W., 15 N.E., S.W., S.E., 16 S.W., 17 N.W., N.E. London is now complete. 1*s.* each.

25-inch—Parish Maps:—

England and Wales (revision):—**Cheshire**, IV. 8; XI. 3; XVIII. 8, 14; XIX. 5, 7, 8, 11, 12, 13, 14; XX. 5, 7, 9; XXVII. 6, 11, 14, 15, 16; XXVIII. 11; XXXV. 2, 3, 4, 6, 12, 14; XXXVI. 1; XLII. 2, 3, 7, 11, 15; L. 2, 15. **Durham**, I. 12; II. 15; III. 13; IV. 1; V. 14; IX. 15, 16; XI. 5, 6, 9, 13; XVI. 3; LI. 4; LVI. 8, 15. **Essex**, XIII. 14; XIX. 7; XXI. 10, 14; XXII. 2, 11; LXXXVIII. 4. **Hampshire**, LXXV. 9, 13, 14; LXXXII. 8, 12; LXXXIII. 1; LXXXIV. 2, 5, 7, 11, 14, 15; LXXXVIII. 13, 14; LXXXIX. 14; XC. 13; XCI 13; XCIII. 7, 10, 14, 16; XCIV. 1, 4, 6, 8, 10, 14, 15; XCV. 1, 6, 8, 11; XCVI. 1, 5, 7, 12. **Hertfordshire**, III. 8, 16; VII. 8; IX. 6, 10, 15; XI. 11; XII. 4, 7, 9, 10, 11; XIII. 10, 15, 16; XIX. 4, 8, 12; XX. 1, 2, 6, 7, 8, 9, 10, 11, 12; XXI. 1, 2, 3, 7, 8, 10, 11, 12, 13; XXII. 1, 5, 9, 13; XXVIII. 2, 6, 7, 10, 11, 15; XXXIV. 8, 15; XXXV. 3, 6, 15, 16; XXXVI. 11; XL. 1; XLI. 1, 6; XLV. 2, 8. **Kent**, V. 10, 11, 14; XIX. 6, 10, 11, 14, 15; XXI. 14; XXIII. 7, 11, 10, 13, 14, 15; XXIV. 13; XXXV. 1, 15, 16; XLVI. 1, 5; XLVII. 1, 3, 5, 6, 7, 8, 9, 11, 13, 14, 15, 16; LVII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16; LXV. 9; LXVI. 13; LXVII. 1, 2, 3, 5, 6, 7; LXXII. 1, 3, 4, 5, 9, 10, 11, 12, 14, 15, 16; LXXIII. 2, 3, 4, 6, 9, 12, 13, 14, 15, 16; LXXXIV. 13; LXXXVI. 1, 2, 5, 6. **Northumberland**, VI. 8, 11, 12, 16; VII. 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16; VIII. 9, 13; X. 1; XI. 8, 12, 16; XII. 1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15; XV. 4; XVI. 1, 2, 3, 4, 6, 7, 16; LXXXIX. 12; CVI. 7, 15; CVII. 9, 11, 13, 14; CX. 3, 4. 8; CXI. 1, 2, 5, 7. **Surrey**, XII. 4; XXII. 13; XXIX. 8; XXX. 9; XXXVII. 1; XLVI. 10. **Sussex**, III. 5; IV. 3, 7; IX. 16; X. 3, 9, 14; XI. 2, 3, 4, 6, 7, 8; XII. 1, 2, 3; XX. 15; XXXIII. 6, 10, 14; XLVII. 2, 10; LII. 9, 13; LX. 8, 12; LXI. 9, 10, 12, 13, 15; LXII. 14; LXIII. 14; LXIV. 1, 2, 3, 4, 5, 6, 7, 16; LXXII. 4; LXXIII. 1, 2; LXXIV. 3; LXXV. 2; LXXVI. 2. **Westmorland**, XLII. 5, 6; XLIII. 5; XLVI. 13. **Tyneside**, comprising the town on both sides of the river Tyne between Newcastle and Tynemouth, is now complete in 27 sheets, with houses ruled. 3*s* each.

(*E. Stanford, Agent.*)

England and Wales. **Geikie.**

Geological Map of England and Wales. Scale 1 : 633,600 or 10 stat. miles to an inch. By Sir A. Geikie, D.SC., LL.D., F.R.S. J. Bartholomew & Co., Edinburgh, 1898. *Price* 12*s.* 6*d.*, mounted on cloth. *Presented by the Publishers.*

The topographical basis of this map is Bartholomew's reduction from the Ordnance Survey, on the scale of 10 miles to an inch. The geological colouring is taken from the published maps of the Geological Survey of England and Wales under the direction of Sir Archibald Geikie. For the scale of the map, it contains a large amount of detailed information, the colours are well chosen, and the registering good. Sections have been placed round the border of the map to explain the geological structure of the country. To the student of the physical geography of the country the map will be found of the greatest use.

Historical Geography. **Poole.**

Historical Atlas of Modern Europe, from the decline of the Roman Empire; comprising also maps of parts of Asia and of the New World, connected with European History. Edited by Reginald Lane Poole, M.A., PH.D., Lecturer in Diplomatic in the University of Oxford. Part xvi. Oxford: The Clarendon Press; London, Edinburgh, and Glasgow: Henry Frowde, M.A.; Edinburgh: W. & A. K. Johnston, 1897. *Price* 3*s.* 6*d.* *Presented by the Clarendon Press.*

This part contains the following maps: No. 10, Europe in the Eighteenth Century prior to the French Revolution, by Walter E. Rhodes, M.A.; No. 16, England and Wales before the Norman Conquest, by W. H. Stevenson, M.A.; No. 85, European Explorations and Colonies, from the Fifteenth Century to the Seventeenth Century, by Hugh E. Egerton, M.A. Each map is accompanied by explanatory letterpress. With regard to the map of European explorations, none of the discoveries in the Arctic Regions are shown.

Switzerland. **Swiss Federal Staff.**

Topographischer Atlas der Schweiz im Massstab der Original-Aufnahmen nach dem Bundesgesetze vom 18. Dezember 1868 durch das eidg. topogr. Büreau gemäss den Direktionen vom Oberst Siegfried veröffentlicht. XLVII. Lieferung: N° 5bis Winkel; 21bis Lauchringen; 250bis Speer; 251, Alt St. Johann; 253, Walenstadt; 256, Berschis; 364, Schwarzsee; 450, Vernier; 450bis Bernex; 477bis Chamossaire; 499, Cerentino; 523bis Chiesa. *Price* 1 *mark each sheet. Presented by the Swiss Federal Staff.*

ASIA.

Indian Government Surveys. **Surveyor-General's Office, Calcutta.**

Indian Atlas, Quarter-sheets, 4 miles to an inch. Sheets: No. 9 S.W., parts of district Hyderabad and Native State of Khairpur (Sind, Bombay Presidency); 10 S.E., part of district Thar and Parkar (Sind, Bombay Presidency); 71 S.E., parts of districts Seoni, Mandla, Narsinghpur, Jubbulpore, and Balaghat (Central Provinces); 91 S.E., parts of districts Raipur, Sambalpur, and Native State of Patna (Central Provinces).—India, showing railways with stations, accompaniment to alphabetical list of stations on Indian railways, corrected to December 31, 1896. 64 miles to an inch, 2 sheets.—Central India and Rajputana Survey, 1 inch to 2 miles. Sheets: Nos. 159, 160, 192, 193, parts of Jodhpore, Bickaneer, and Shaikhawati (Rajputana Agency), Season 1876–77.—Bombay Survey, 1 inch to a mile. Sheet 349, distfict Bijapur, Seasons 1894–95–96.—Bengal Survey, 1 inch to a mile. Sheet No. 138 (Preliminary edition), district Puri, Seasons 1890-91 and 1894–95; No. 246, district Balasore, Season 1893–94.—South-Eastern Frontier, 8 miles to an inch. Sheet No. 10, parts of district Mergui (Lower Burma) and of Siam, Seasons 1865–67 and 1889–93.—Indus Riverain Survey, 1 inch to a mile. Sheets Nos. 50 and 52, district Karachi and Hyderabad, Season 1894–95.—Skeleton Map of the Punjab and surrounding countries, 32 miles to an inch. Additions and corrections to railways, etc., to July, 1897.—Province of Assam, 16 miles to an inch, with additions and corrections to 1897.—District Rájsháhi, Bengal, 4 miles to an inch, with additions to 1897.—Mysore and Coorg, 16 miles to an inch. September, 1897.—District Lahore, Punjab, 8 miles to an inch, 1897.—District Peshâwar, Punjab, 8 miles to an inch, 1897.—District Nagpur, Central Provinces, 8 miles to an inch, December, 1897.—District Biláspur, Central Provinces, 16 miles to an inch, 1897.—District Sonthál Parganas, Bengal, 10 miles to an inch, 1890.—District Darbhanga, Bengal, 8 miles to an inch, 1891.—Districts Bhamo and Myitkyina, Upper Burma, 8 miles to an inch. Additions and corrections to 1896.—Survey of India Department, Charts of Triangulation, 2 miles to an inch. No. 14 Party (Central Provinces), Seasons 1894-95 and 1895–96. Sheets 61, 62, 65, 66,

81, 85 (Central Provinces). No. 18 Party (Himalaya). Sheet 314 (Punjab), Season 1888–89.—Map of Tenasserim, compiled by Arthur H. Bagge, Lieut. R.E., Her Britannic Majesty's Commissioner for the settlement of the boundary between the Kingdom of Siam and the British Province of Tenasserim. In 6 sheets, 4 miles to an inch, with additions to boundaries to 1897.—Part of North-West Frontier, 16 miles to an inch, September, 1897.—Map of portion of Tibet explored by Captain H. H. P. Deasy, 16th Lancers, in 1896, 8 miles to an inch, 2 sheets, July, 1897.

(*E. Stanford, Agent.*)

AFRICA.

Niger and Nile Regions. **Johnston.**

W. & A. K. Johnston's Maps to illustrate the Niger and Upper Nile Questions. Four maps on one sheet. W. & A. K. Johnston, Edinburgh, 1898. *Price* 2*s.* *Presented by the Publishers.*

These maps, and the accompanying notes, will be found useful for reference with regard to the questions at issue at the present time, in the Niger territory and the upper Nile.

Somaliland. **Ghika.**

Expédition Ghika au Pays des Somalis. (Du mois d'Octobre 1895 jusqu'en Mars 1896) fait d'après les relevés du prince Démètre Ghika par le Prof. Dr. Philippe Paulitschke. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Th. Bannwarth, Vienna. With Prince Nicholas Ghika's book, 'Cinq Mois au Pays des Somalis.'

——— **Wickenburg.**

Reiseroute des Grafen Eduard Wickenburg im Somâllande Juli bis Oktober 1897. Nach den Aufnahmen den Reisenden bearbeitet von Prof. Dr. Philipp Paulitschke. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. *Petermanns Geographische Mitteilungen.* Jahrgang 1898, Tafel 5. Gotha: J. Perthes. *Presented by the Publisher.*

AUSTRALIA.

Western Australia. **Carnegie.**

Map showing routes of the Exploring and Prospecting Expedition, between Coolgardie and Kimberley, equipped and led by the Hon. David W. Carnegie, 1896-97. Scale 1 : 1,013,760 or 16 stat. miles to an inch. *Presented by the Hon. David W. Carnegie.*

The explorations shown on this map, being in a north and south direction, are mainly important from the fact that Mr. Carnegie's routes connect those followed by other expeditions, which have generally been from east to west. The map contains considerable detail along the routes followed, and descriptive notes, together with sketches showing the character of the country.

GENERAL.

History of Early Cartography. **Nordenskiöld.**

A. E. Nordenskiöld: Periplus, an Essay on the Early History of Charts and Sailing Directions. Translated from the Swedish original by Francis A. Bather. With numerous reproductions of old charts and maps. Stockholm: P. A. Norstedt and Sons, 1897. *Price* £10.

A special notice of this important atlas will appear in the *Journal.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during January and February, 1898. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
2548	m = 1·1	Spain, west coast:—Vigo and Pontevedra bays. 2*s.*
1878	m = var.	Plans of anchorages in the Ægean sea:—Port Ajano, Sighajik harbour, Port Isene, Port Tigani (reproduction). 1*s.* 6*d.*
1229	m = 0·07	Africa, west coast:—Cape Ghir to Garnet head, including the Canary islands. 2*s.* 6*d.*

No.	Inches.	
1519	m = 8·0	Plans in the Si-kiang or west river :—Samshui reach, Tak-hing, Wu-chau-fu. 1*s.* 6*d.*
2972	m = 1·45	Korea :—Shadwell and Cargodo gulfs. 1*s.* 6*d.*
2868	m = 1·85 m = 3·7	South Pacific :—Anchorages on the north coast of Tubuai island. 1*s.* 6*d.*
631		Smyth channel :—Plan added, Burgoyne bay.
825		Andaman islands :—Plan added, Barren island anchorage.
840		Nicobar islands :—Plan added, Laful anchorage.
766		Ellice islands, south-eastern group :—New plan, Nukulailai ; Plan added, Nukulailai anchorage.

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

No. A. to P., Index charts (16 sheets). 2302, Gulf of Bothnia :—Tome point to Tauvõ. 2365, Germany :—Rostock to Arkona light. 2366, Germany :—Arkona to Dievenow river. 1343, France, west coast :—Adour river. 1492, Adriatic sea :—Brindisi harbour. 1315, Bermuda :—The Narrows. 490, Lake Erie, west end. 2020, Bay of Fundy :—Campobello island. 21, Magellan strait :—Second narrows to Cape Pillar. 877, Chile :—Guia narrows to Concepcion channel. 1289, Chile :—Guaytecas islands to Cape St. Antonio. 1303, Chile :—Approaches to Lota and Coronel. 2323, Mexico, south-west coast :—Manzanilla bay to the Gulf of California. 1924, Anchorages on the coast of Lower California. 2348, Alaska :—Sitka harbour and approaches. 607, Africa, west coast :—Entrances to the Salum and Jumbas rivers. 1849, Africa, south coast :—Simons bay. 1401, Mauritius :—Grand port. 2284, Plans of anchorages on the west coast of Sumatra. 934, Eastern Archipelago :—Surabaya, Bali, and Sapudi straits, etc. 2637, Strait of Makasser, south part. 416, Palawan island :—Malanut and Nakoda. 2062, Cochin China :—Tong-king gulf. 2562, China :—Chu-kiang or Canton river. 2734, China :—Si-kiang or West river (sheet 2). 2735, China :—Si-kiang or West river (sheet 3). 1767, China :—Amoy harbours and approaches. 1199, China :—Koe-shan islands to the Yang-tse Kiang. 1256, China :—Gulfs of Pe-chili and Liau-tung. 1602, China :—Approaches to the Yang-tse Kiang. 2981, Japan :—Furubira Wan to Ishikari Gawa.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
2548 Vigo bay.	New Chart. Vigo and Pontevedra bays	2548
1878 Port Tigani. 1673 Port Ajano. 1668 Sighajik harbour. 1529 Port Isene.	New Chart. Plans of anchorages in the Ægean sea .	1878
1229 Santa Cruz to Cape Bojador, including the Canary islands.	New Chart. Cape Ghir to Garnet head, including the Canary islands	1229
2868 Tubuai island anchorage.	New Chart. Tubuai island	2868

(*J. D. Potter, Agent.*)

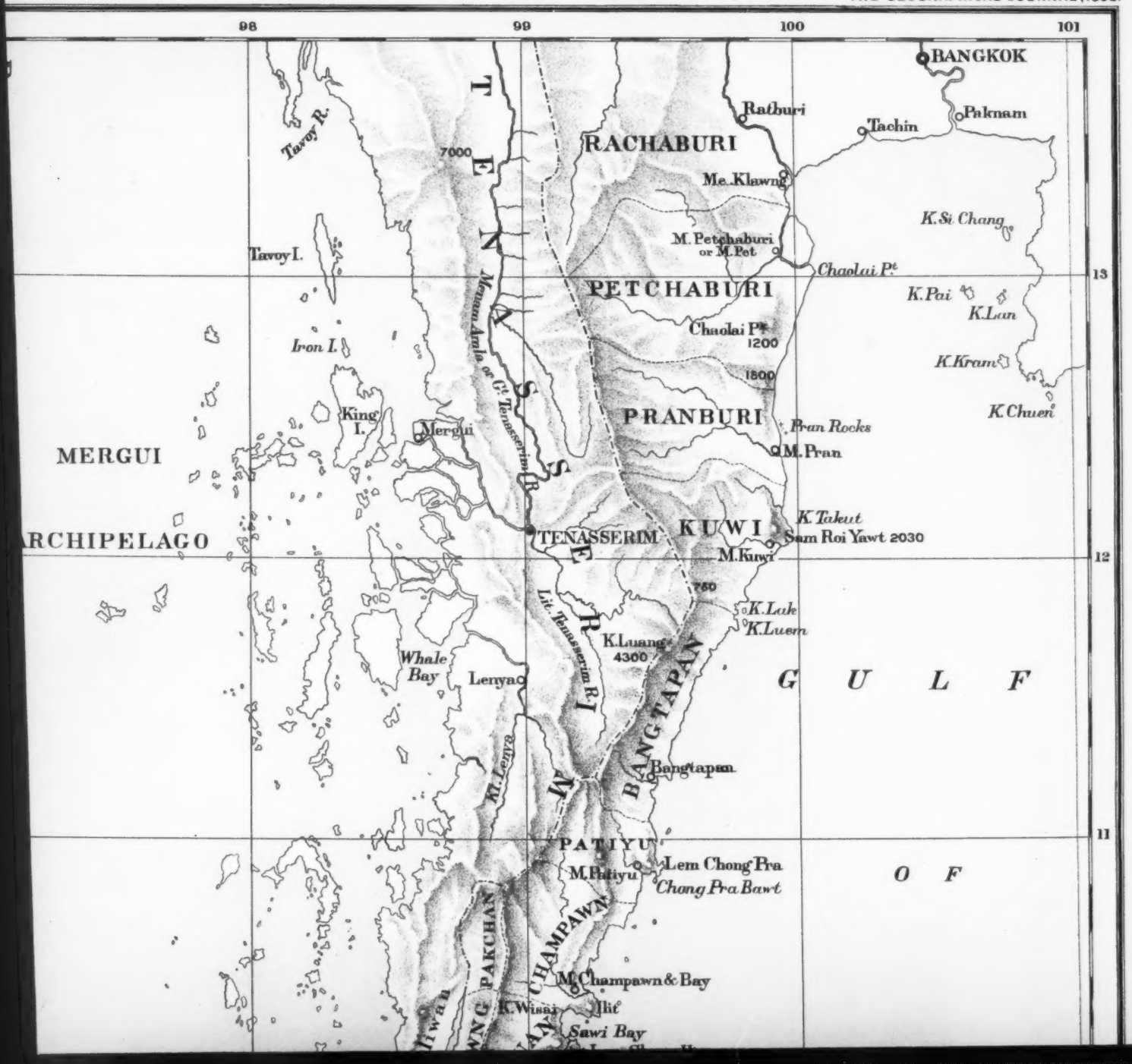
United States Charts. **U.S Hydrographic Office.**

Pilot Charts for the North Atlantic Ocean for February and March, 1898, and North Pacific Ocean for March, 1898. Published at the Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

97
B
A
13
Y
ARC
12
O
F
11
B
E


98
99
100
101
13
12
11
BANGKOK
Ratburi
Tachin
Paknam
RACHABURI
Me. Klawng
K. Si Chang
M. Petchaburi or M. Pet
Chaolai Pt.
PETCHABURI
K. Pai
K. Lan
Chaolai Pt.
1200
1800
K. Kram
K. Chuen
PRANBURI
Pran Rocks
M. Pran
K. Takut
Sam Roi Yawt 2030
M. Kuwi
KUWI
TENASSERIM
750
K. Lak
K. Luem
K. Luang
4300
Lit. Tenasserim R.
Whale Bay
Lenya
BANGTAPAN
Bangtapan
PATIYU
M. Patiyu
Lem Chong Pra
Chong Pra Bawt
CHAMPAWN
M. Champawn & Bay
Sawi Bay
PAKCHAN
Tavoy R.
Tavoy I.
Iron I.
King I.
Mergui
MERGUI
ARCHIPELAGO
TENASSERIM
Mawan Arala or Ct. Tenasserim R.
7000
GULF
OF

E

N

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CEN

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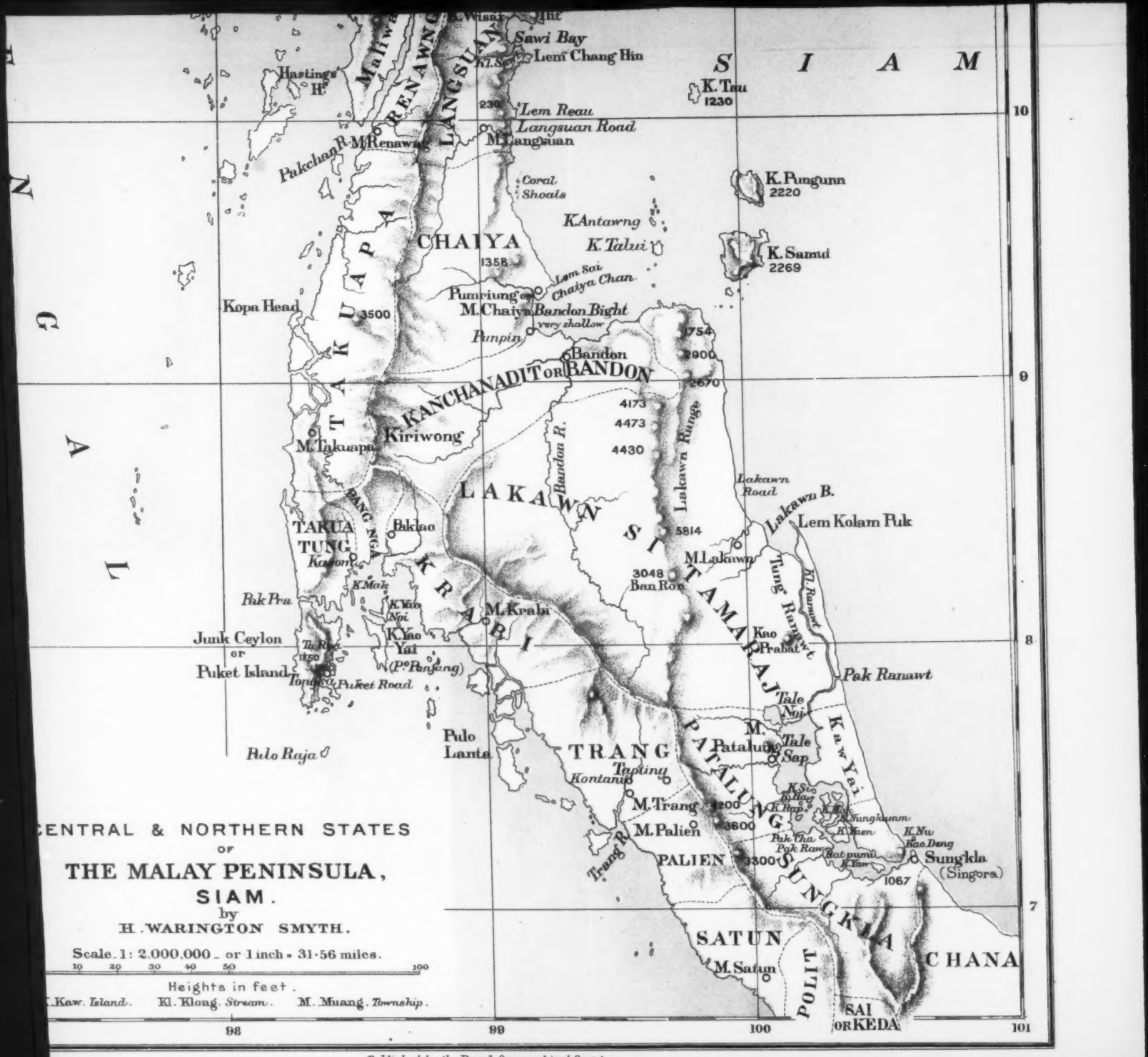
K.Ka

97



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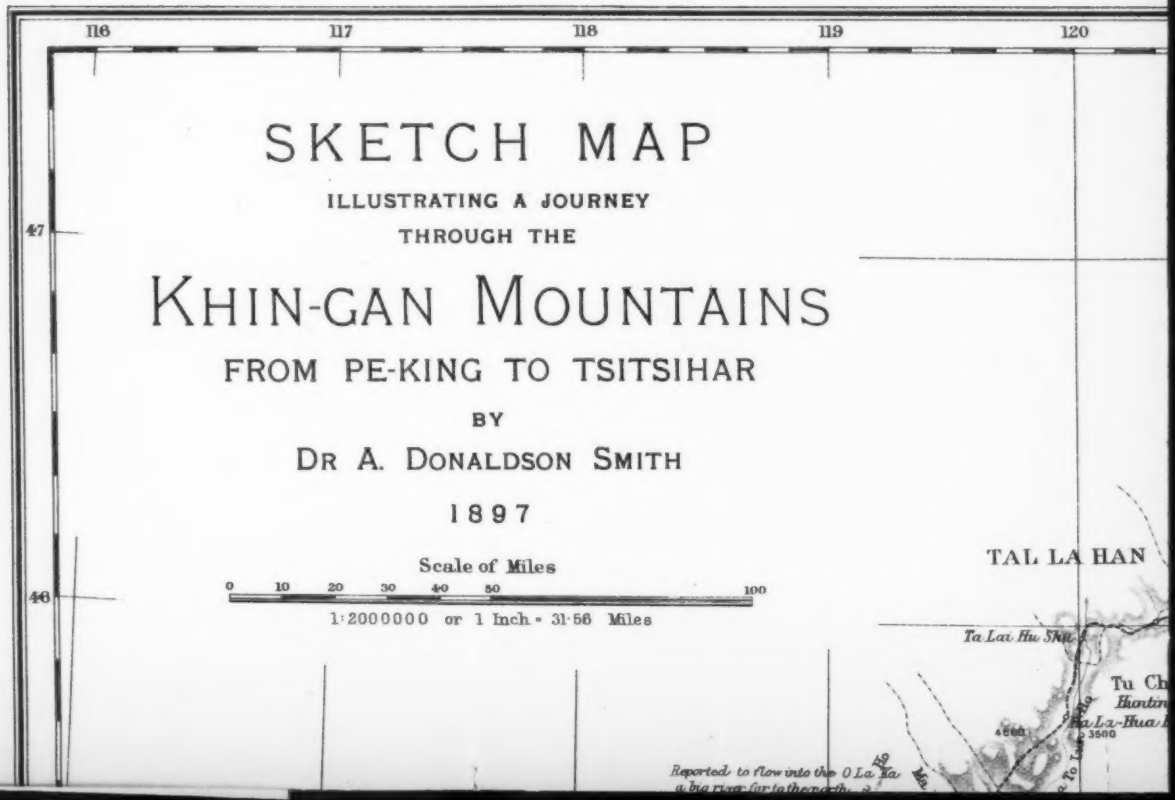
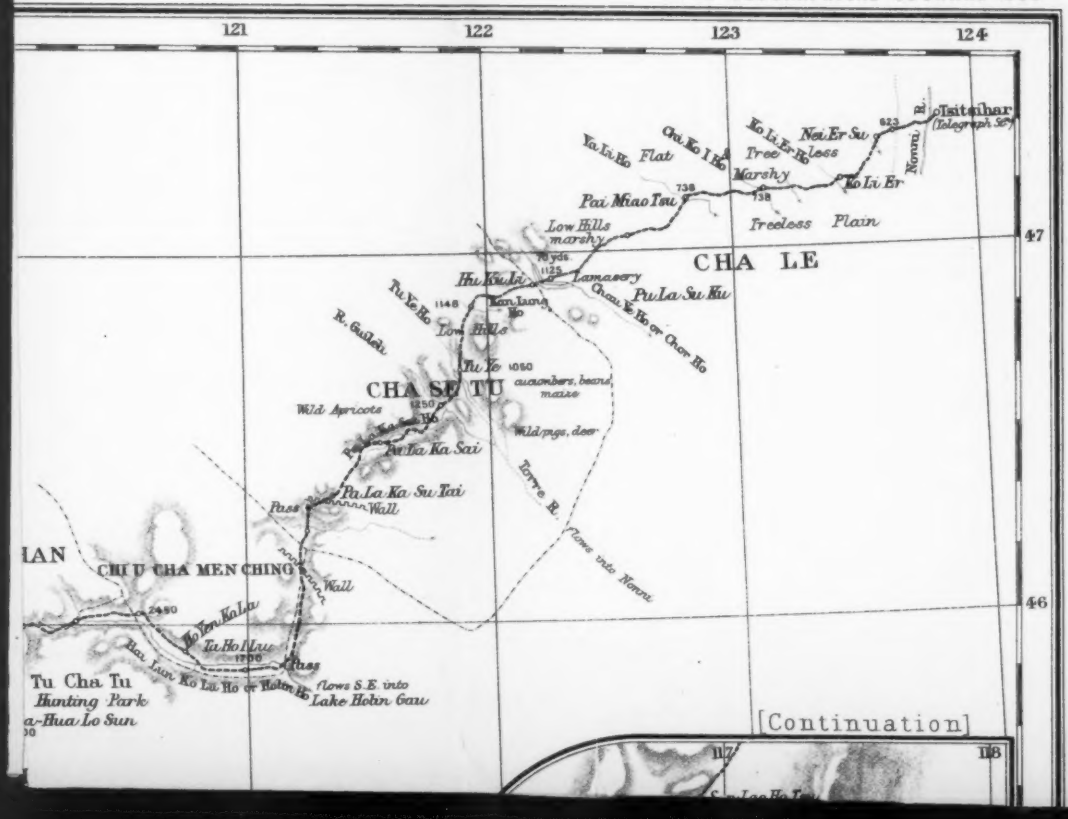
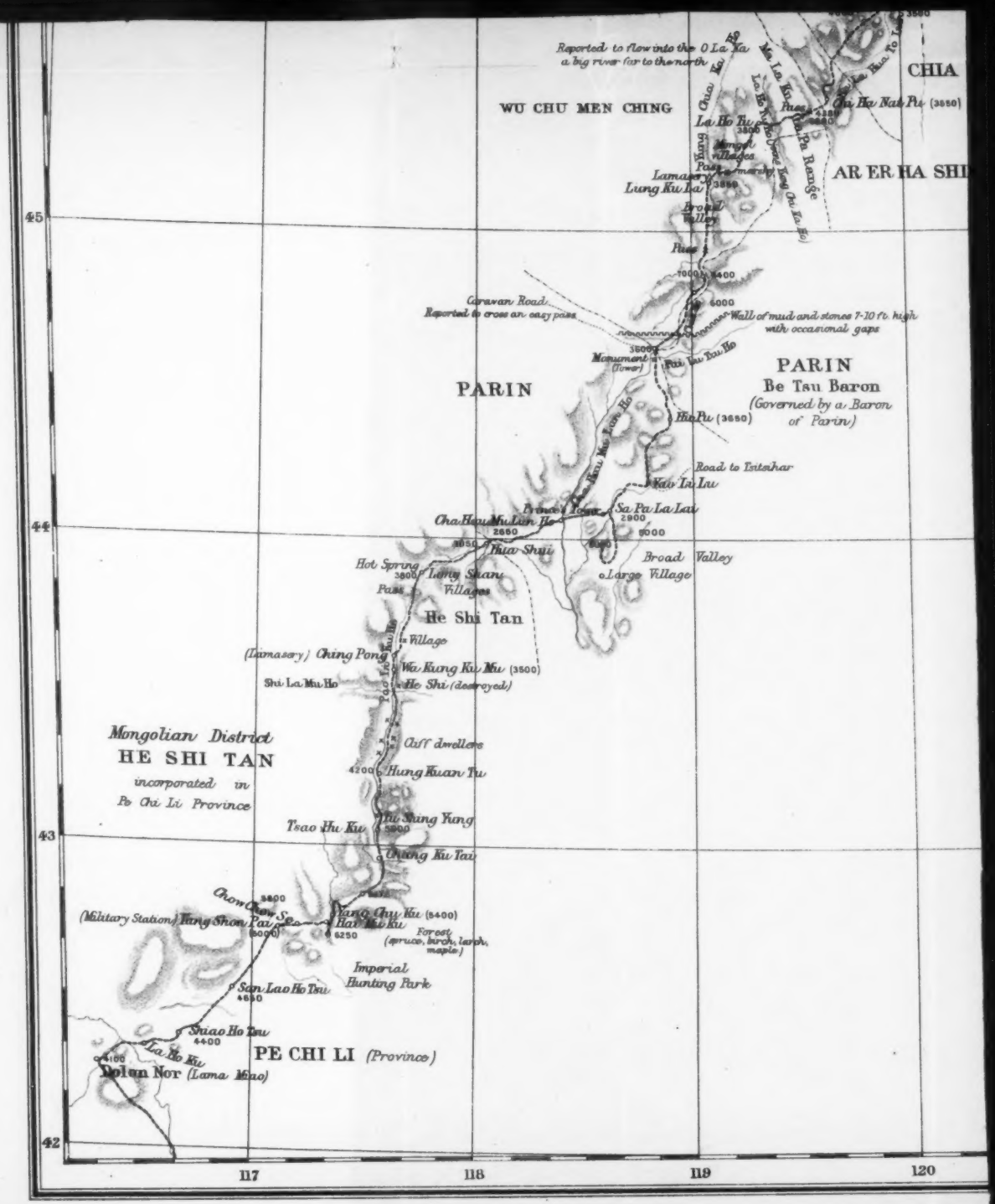

116
117
118
119
120
47
46
SKETCH MAP
ILLUSTRATING A JOURNEY
THROUGH THE
KHIN-GAN MOUNTAINS
FROM PE-KING TO TSITSIHAR
BY
DR A. DONALDSON SMITH
1897
Scale of Miles
0 10 20 30 40 50 100
1:2000000 or 1 Inch = 31·56 Miles
TAI LA HAN
Ta Lai Hu Shan
Tu Ch
Hantin
Ta La-Hua
4600
3500
Reported to flow into the O La La
a big river far to the north


121
122
123
124
47
46
Isitsihar
(Telegraph Sta.)
Nonni R.
Nai Er Su
623
Ko Li Er Ri
Tree less
Marshy
Ko Li Er
738
738
Pai Miao Tou
Treeless Plain
Low Hills
marshy
Ya Li Ho
Flat
Cha Ko I Ho
CHA LE
Lamasery
Hu Ku Li
Pu La Su Ku
Chan Ye Ho or Chor Ho
Tu Ye Ho
1148
Low Hills
R. Gailah
Tu Ye
1050
cucumbers, beans, maize
CHA SE TU
Wild Apricots
Wild pigs, deer
Pu La Ka Sai
Pu La Ka Su Tai
Pass
Wall
Torre R.
flows into Nonni
IAN
CHI U CHA MEN CHING
Wall
Ko Yen Ka La
2450
Tu Ho Huo
1700
Hua Lun Ko Lu Ho or Holon Ho
flows S.E. into
Lake Holun Gau
Tu Cha Tu
Hunting Park
a-Hua Lo Sun
[Continuation]
117
118



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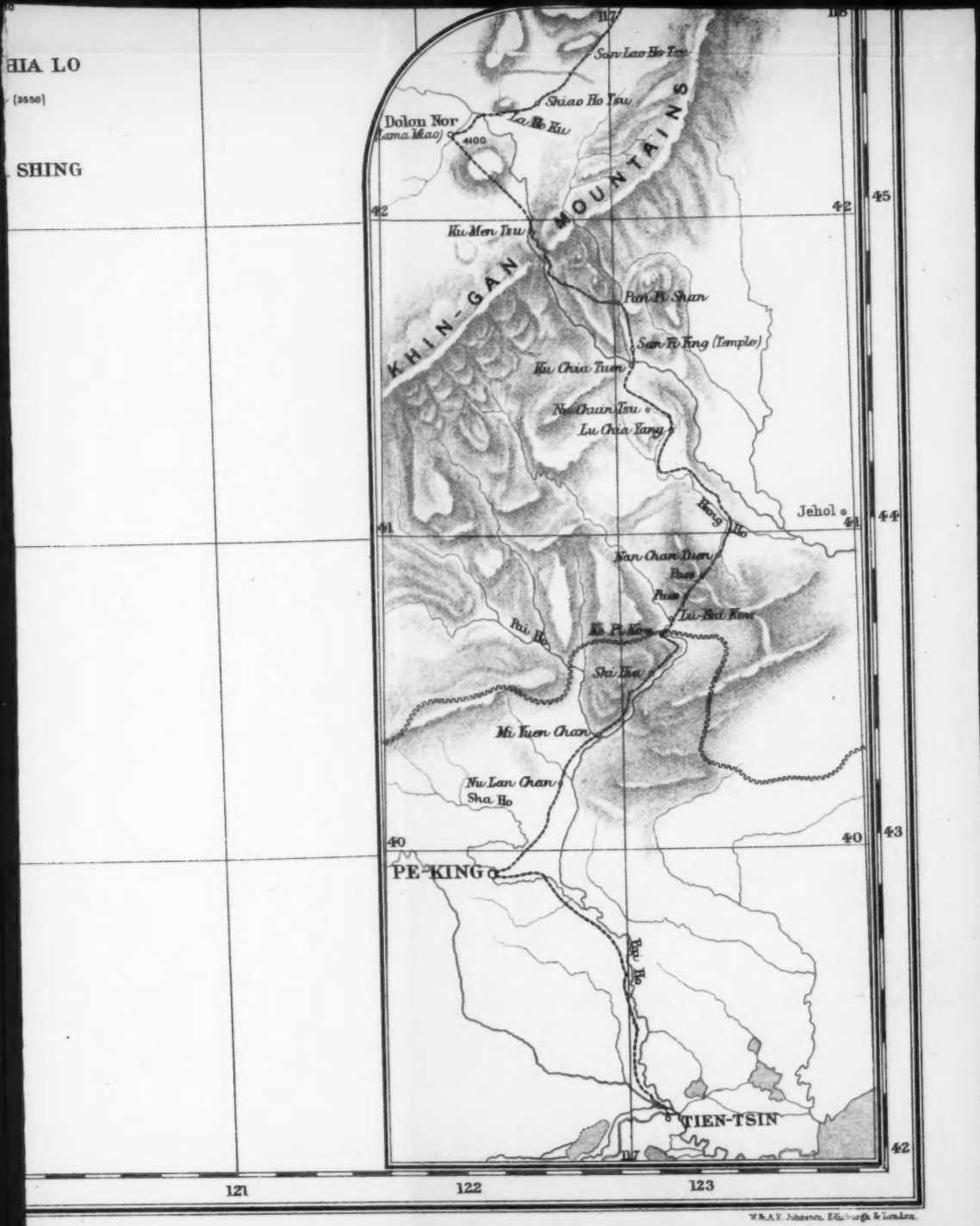

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